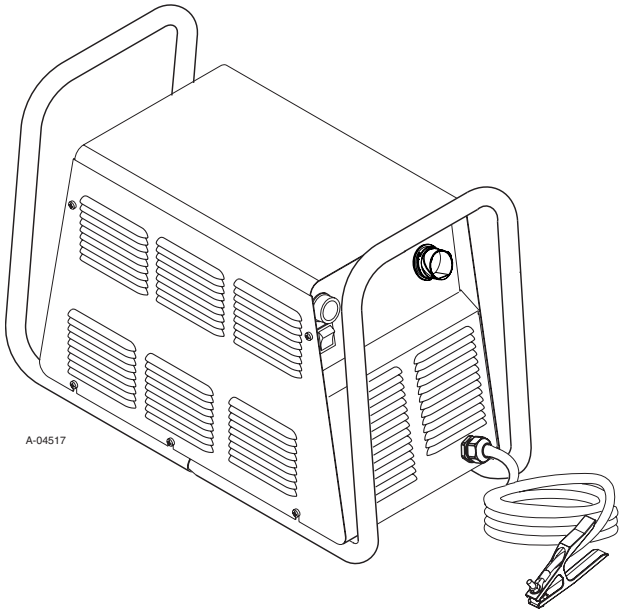
THERMAL DYNAMICS®

81

CUTMASTER™

PLASMA CUTTING SYSTEM



Service Manual

Rev. AC.01 **Date:** April 13, 2007 **Manual #** 0-2957

Operating Features:

60 AMP	DC	1 PHASE	3 PHASE	208-230 V	400 V	400 V (CE)	460 V	600 V

WARNINGS

Read and understand this entire Manual and your employer's safety practices before installing, operating, or servicing the equipment.

While the information contained in this Manual represents the Manufacturer's best judgement, the Manufacturer assumes no liability for its use.

Plasma Cutting Power Supply
CutMaster™ 81
Operating Manual Number 0-2957

Covered under U.S. Patents.

Published by:
Thermal Dynamics Corporation
82 Benning Street
West Lebanon, New Hampshire, USA 03784
(603) 298-5711

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Printed in the United States of America

Publication Date: April 13, 2007

Record the following information for Warranty purposes:

Where Purchased:_____

Purchase Date:_____

Power Supply Serial #:_____

Torch Serial #:_____

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SECTION 1: GENERAL INFORMATION

1.01 Notes, Cautions and Warnings

Throughout this manual, notes, cautions, and warnings are used to highlight important information. These highlights are categorized as follows:

NOTE

An operation, procedure, or background information which requires additional emphasis or is helpful in efficient operation of the system.

CAUTION

A procedure which, if not properly followed, may cause damage to the equipment.

WARNING

A procedure which, if not properly followed, may cause injury to the operator or others in the operating area.

1.02 Important Safety Precautions

WARNINGS

OPERATION AND MAINTENANCE OF PLASMA ARC EQUIPMENT CAN BE DANGEROUS AND HAZARDOUS TO YOUR HEALTH.

Plasma arc cutting produces intense electric and magnetic emissions that may interfere with the proper function of cardiac pacemakers, hearing aids, or other electronic health equipment. Persons who work near plasma arc cutting applications should consult their medical health professional and the manufacturer of the health equipment to determine whether a hazard exists.

To prevent possible injury, read, understand and follow all warnings, safety precautions and instructions before using the equipment. Call 1-603-298-5711 or your local distributor if you have any questions.

GASES AND FUMES

Gases and fumes produced during the plasma cutting process can be dangerous and hazardous to your health.

- Keep all fumes and gases from the breathing area. Keep your head out of the welding fume plume.
- Use an air-supplied respirator if ventilation is not adequate to remove all fumes and gases.
- The kinds of fumes and gases from the plasma arc depend on the kind of metal being used, coatings on the metal, and the different processes. You must be very careful when cutting or welding any metals which may contain one or more of the following:

Antimony	Chromium	Mercury
Arsenic	Cobalt	Nickel
Barium	Copper	Selenium
Beryllium	Lead	Silver
Cadmium	Manganese	Vanadium

- Always read the Material Safety Data Sheets (MSDS) that should be supplied with the material you are using. These MSDSs will give you the information regarding the kind and amount of fumes and gases that may be dangerous to your health.
- For information on how to test for fumes and gases in your workplace, refer to item 1 in Subsection 1.03, Publications in this manual.
- Use special equipment, such as water or down draft cutting tables, to capture fumes and gases.
- Do not use the plasma torch in an area where combustible or explosive gases or materials are located.
- Phosgene, a toxic gas, is generated from the vapors of chlorinated solvents and cleansers. Remove all sources of these vapors.
- This product, when used for welding or cutting, produces fumes or gases which contain chemicals known to the State of California to cause birth defects and, in some cases, cancer. (California Health & Safety Code Sec. 25249.5 et seq.)

ELECTRIC SHOCK

Electric Shock can injure or kill. The plasma arc process uses and produces high voltage electrical energy. This electric energy can cause severe or fatal shock to the operator or others in the workplace.

- Never touch any parts that are electrically "live" or "hot."

- Wear dry gloves and clothing. Insulate yourself from the work piece or other parts of the welding circuit.
- Repair or replace all worn or damaged parts.
- Extra care must be taken when the workplace is moist or damp.
- Install and maintain equipment according to NEC code, refer to item 9 in Subsection 1.03, Publications.
- Disconnect power source before performing any service or repairs.
- Read and follow all the instructions in the Operating Manual.


FIRE AND EXPLOSION

Fire and explosion can be caused by hot slag, sparks, or the plasma arc.

- Be sure there is no combustible or flammable material in the workplace. Any material that cannot be removed must be protected.
- Ventilate all flammable or explosive vapors from the workplace.
- Do not cut or weld on containers that may have held combustibles.
- Provide a fire watch when working in an area where fire hazards may exist.
- Hydrogen gas may be formed and trapped under aluminum workpieces when they are cut underwater or while using a water table. **DO NOT** cut aluminum alloys underwater or on a water table unless the hydrogen gas can be eliminated or dissipated. Trapped hydrogen gas that is ignited will cause an explosion.


NOISE

Noise can cause permanent hearing loss. Plasma arc processes can cause noise levels to exceed safe limits. You must protect your ears from loud noise to prevent permanent loss of hearing.

- To protect your hearing from loud noise, wear protective ear plugs and/or ear muffs. Protect others in the workplace.
- Noise levels should be measured to be sure the decibels (sound) do not exceed safe levels.
- For information on how to test for noise, see item 1 in Subsection 1.03, Publications, in this manual.


PLASMA ARC RAYS

Plasma Arc Rays can injure your eyes and burn your skin. The plasma arc process produces very bright ultra violet and infra red light. These arc rays will damage your eyes and burn your skin if you are not properly protected.

- To protect your eyes, always wear a welding helmet or shield. Also always wear safety glasses with side shields, goggles or other protective eye wear.
- Wear welding gloves and suitable clothing to protect your skin from the arc rays and sparks.
- Keep helmet and safety glasses in good condition. Replace lenses when cracked, chipped or dirty.
- Protect others in the work area from the arc rays. Use protective booths, screens or shields.
- Use the shade of lens as suggested in the following per ANSI/ASC Z49.1:

Arc Current	Minimum Protective Shade No.	Suggested Shade No.
Less Than 300*	8	9
300 - 400*	9	12
400 - 800*	10	14

** These values apply where the actual arc is clearly seen. Experience has shown that lighter filters may be used when the arc is hidden by the workpiece.*

1.03 Publications

Refer to the following standards or their latest revisions for more information:

1. OSHA, SAFETY AND HEALTH STANDARDS, 29CFR 1910, obtainable from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402
2. ANSI Standard Z49.1, SAFETY IN WELDING AND CUTTING, obtainable from the American Welding Society, 550 N.W. LeJeune Rd, Miami, FL 33126
3. NIOSH, SAFETY AND HEALTH IN ARC WELDING AND GAS WELDING AND CUTTING, obtainable from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402
4. ANSI Standard Z87.1, SAFE PRACTICES FOR OCCUPATION AND EDUCATIONAL EYE AND FACE PROTECTION, obtainable from American National Standards Institute, 1430 Broadway, New York, NY 10018
5. ANSI Standard Z41.1, STANDARD FOR MEN'S SAFETY-TOE FOOTWEAR, obtainable from the American National Standards Institute, 1430 Broadway, New York, NY 10018

6. ANSI Standard Z49.2, FIRE PREVENTION IN THE USE OF CUTTING AND WELDING PROCESSES, obtainable from American National Standards Institute, 1430 Broadway, New York, NY 10018

7. AWS Standard A6.0, WELDING AND CUTTING CONTAINERS WHICH HAVE HELD COMBUSTIBLES, obtainable from American Welding Society, 550 N.W. LeJeune Rd, Miami, FL 33126

8. NFPA Standard 51, OXYGEN-FUEL GAS SYSTEMS FOR WELDING, CUTTING AND ALLIED PROCESSES, obtainable from the National Fire Protection Association, Batterymarch Park, Quincy, MA 02269

9. NFPA Standard 70, NATIONAL ELECTRICAL CODE, obtainable from the National Fire Protection Association, Batterymarch Park, Quincy, MA 02269

10. NFPA Standard 51B, CUTTING AND WELDING PROCESSES, obtainable from the National Fire Protection Association, Batterymarch Park, Quincy, MA 02269

11. CGA Pamphlet P-1, SAFE HANDLING OF COMPRESSED GASES IN CYLINDERS, obtainable from the Compressed Gas Association, 1235 Jefferson Davis Highway, Suite 501, Arlington, VA 22202

12. CSA Standard W117.2, CODE FOR SAFETY IN WELDING AND CUTTING, obtainable from the Canadian Standards Association, Standards Sales, 178 Rexdale Boulevard, Rexdale, Ontario, Canada M9W 1R3

13. NWSA booklet, WELDING SAFETY BIBLIOGRAPHY obtainable from the National Welding Supply Association, 1900 Arch Street, Philadelphia, PA 19103

14. American Welding Society Standard AWSF4.1, RECOMMENDED SAFE PRACTICES FOR THE PREPARATION FOR WELDING AND CUTTING OF CONTAINERS AND PIPING THAT HAVE HELD HAZARDOUS SUBSTANCES, obtainable from the American Welding Society, 550 N.W. LeJeune Rd, Miami, FL 33126

15. ANSI Standard Z88.2, PRACTICE FOR RESPIRATORY PROTECTION, obtainable from American National Standards Institute, 1430 Broadway, New York, NY 10018

1.04 Note, Attention et Avertissement

Dans ce manuel, les mots “note,” “attention,” et “avertissement” sont utilisés pour mettre en relief des informations à caractère important. Ces mises en relief sont classifiées comme suit :

NOTE

Toute opération, procédure ou renseignement général sur lequel il importe d’insister davantage ou qui contribue à l’efficacité de fonctionnement du système.

ATTENTION

Toute procédure pouvant résulter l’endommagement du matériel en cas de non-respect de la procédure en question.

AVERTISSEMENT

Toute procédure pouvant provoquer des blessures de l’opérateur ou des autres personnes se trouvant dans la zone de travail en cas de non-respect de la procédure en question.

1.05 Precautions De Securite Importantes

AVERTISSEMENTS

L’OPÉRATION ET LA MAINTENANCE DU MATÉRIEL DE SOUDAGE À L’ARC AU JET DE PLASMA PEUVENT PRÉSENTER DES RISQUES ET DES DANGERS DE SANTÉ.

Coupant à l’arc au jet de plasma produit de l’énergie électrique haute tension et des émissions magnétique qui peuvent interférer la fonction propre d’un “pacemaker” cardiaque, les appareils auditif, ou autre matériel de santé electronique. Ceux qui travail près d’une application à l’arc au jet de plasma devrait consulter leur membre professionel de médication et le manufacturier de matériel de santé pour déterminer s’il existe des risques de santé.

Il faut communiquer aux opérateurs et au personnel TOUS les dangers possibles. Afin d’éviter les blessures possibles, lisez, comprenez et suivez tous les avertissements, toutes les précautions de sécurité et toutes les consignes avant d’utiliser le matériel. Composez le + 603-298-5711 ou votre distributeur local si vous avez des questions.

FUMÉE et GAZ

La fumée et les gaz produits par le procédé de jet de plasma peuvent présenter des risques et des dangers de santé.

- Eloignez toute fumée et gaz de votre zone de respiration. Gardez votre tête hors de la plume de fumée provenant du chalumeau.
- Utilisez un appareil respiratoire à alimentation en air si l'aération fournie ne permet pas d'éliminer la fumée et les gaz.
- Les sortes de gaz et de fumée provenant de l'arc de plasma dépendent du genre de métal utilisé, des revêtements se trouvant sur le métal et des différents procédés. Vous devez prendre soin lorsque vous coupez ou soudez tout métal pouvant contenir un ou plusieurs des éléments suivants:

antimoine	cadmium	mercure
argent	chrome	nickel
arsenic	cobalt	plomb
baryum	cuivre	sélénium
béryllium	manganèse	vanadium

- Lisez toujours les fiches de données sur la sécurité des matières (sigle américain "MSDS"); celles-ci devraient être fournies avec le matériel que vous utilisez. Les MSDS contiennent des renseignements quant à la quantité et la nature de la fumée et des gaz pouvant poser des dangers de santé.
- Pour des informations sur la manière de tester la fumée et les gaz de votre lieu de travail, consultez l'article 1 et les documents cités à la page 5.
- Utilisez un équipement spécial tel que des tables de coupe à débit d'eau ou à courant descendant pour capter la fumée et les gaz.
- N'utilisez pas le chalumeau au jet de plasma dans une zone où se trouvent des matières ou des gaz combustibles ou explosifs.
- Le phosgène, un gaz toxique, est généré par la fumée provenant des solvants et des produits de nettoyage chlorés. Eliminez toute source de telle fumée.
- Ce produit, dans le procéder de soudage et de coupe, produit de la fumée ou des gaz pouvant contenir des éléments reconnu dans L'état de la Californie, qui peuvent causer des défauts de naissance et le cancer. (La sécurité de santé en Californie et la code sécurité Sec. 25249.5 et seq.)



CHOC ELECTRIQUE

Les chocs électriques peuvent blesser ou même tuer. Le procédé au jet de plasma requiert et produit de l'énergie électrique haute tension. Cette énergie électrique peut produire des chocs graves, voire mortels, pour l'opérateur et les autres personnes sur le lieu de travail.

- Ne touchez jamais une pièce "sous tension" ou "vive"; portez des gants et des vêtements secs. Isolez-vous de la pièce de travail ou des autres parties du circuit de soudage.
- Réparez ou remplacez toute pièce usée ou endommagée.
- Prenez des soins particuliers lorsque la zone de travail est humide ou moite.
- Montez et maintenez le matériel conformément au Code électrique national des Etats-Unis. (Voir la page *5*, article 9.)
- Débranchez l'alimentation électrique avant tout travail d'entretien ou de réparation.
- Lisez et respectez toutes les consignes du Manuel de consignes.



INCENDIE ET EXPLOSION

Les incendies et les explosions peuvent résulter des scories chaudes, des étincelles ou de l'arc de plasma. Le procédé à l'arc de plasma produit du métal, des étincelles, des scories chaudes pouvant mettre le feu aux matières combustibles ou provoquer l'explosion de fumées inflammables.

- Soyez certain qu'aucune matière combustible ou inflammable ne se trouve sur le lieu de travail. Protégez toute telle matière qu'il est impossible de retirer de la zone de travail.
- Procurez une bonne aération de toutes les fumées inflammables ou explosives.
- Ne coupez pas et ne soudez pas les conteneurs ayant pu renfermer des matières combustibles.
- Prévoyez une veille d'incendie lors de tout travail dans une zone présentant des dangers d'incendie.
- Le gas hydrogène peut se former ou s'accumuler sous les pièces de travail en aluminium lorsqu'elles sont coupées sous l'eau ou sur une table d'eau. NE PAS couper les alliages en aluminium sous l'eau ou sur une table d'eau à moins que le gas hydrogène peut s'échapper ou se dissiper. Le gas hydrogène accumulé explosera si enflammé.



RAYONS D'ARC DE PLASMA

Les rayons provenant de l'arc de plasma peuvent blesser vos yeux et brûler votre peau. Le procédé à l'arc de plasma produit une lumière infra-rouge et des rayons

ultra-violets très forts. Ces rayons d'arc nuiront à vos yeux et brûleront votre peau si vous ne vous protégez pas correctement.

- Pour protéger vos yeux, portez toujours un casque ou un écran de soudeur. Portez toujours des lunettes de sécurité munies de parois latérales ou des lunettes de protection ou une autre sorte de protection oculaire.
- Portez des gants de soudeur et un vêtement protecteur approprié pour protéger votre peau contre les étincelles et les rayons de l'arc.
- Maintenez votre casque et vos lunettes de protection en bon état. Remplacez toute lentille sale ou comportant fissure ou rognure.
- Protégez les autres personnes se trouvant sur la zone de travail contre les rayons de l'arc en fournissant des cabines ou des écrans de protection.
- Utilisez la nuance de lentille qui est suggèrée dans le recommendation qui suivent ANSI/ASC Z49.1:

Courant Arc	Nuance Minimum Protective Numéro	Nuance Suggerée Numéro
Moins de 300*	8	9
300 - 400*	9	12
400 - 800*	10	14

** Ces valeurs s'appliquent ou l'arc actuel est observé clairement. L'experience a démontrer que les filtres moins foncés peuvent être utilisés quand l'arc est caché par moiceau de travail.*


BRUIT

Le bruit peut provoquer une perte permanente de l'ouïe. Les procédés de soudage à l'arc de plasma peuvent provoquer des niveaux sonores supérieurs aux limites normalement acceptables. Vous dú4ez vous protéger les oreilles contre les bruits forts afin d'éviter une perte permanente de l'ouïe.

- Pour protéger votre ouïe contre les bruits forts, portez des tampons protecteurs et/ou des protections auriculaires. Protégez également les autres personnes se trouvant sur le lieu de travail.
- Il faut mesurer les niveaux sonores afin d'assurer que les décibels (le bruit) ne dépassent pas les niveaux sûrs.
- Pour des renseignements sur la manière de tester le bruit, consultez l'article 1, page 5.

1.06 Documents De Reference

Consultez les normes suivantes ou les révisions les plus récentes ayant été faites à celles-ci pour de plus amples renseignements :

1. OSHA, NORMES DE SÉCURITÉ DU TRAVAIL ET DE PROTECTION DE LA SANTÉ, 29CFR 1910, disponible auprès du Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402
2. Norme ANSI Z49.1, LA SÉCURITÉ DES OPÉRATIONS DE COUPE ET DE SOUDAGE, disponible auprès de la Société Américaine de Soudage (American Welding Society), 550 N.W. LeJeune Rd., Miami, FL 33126
3. NIOSH, LA SÉCURITÉ ET LA SANTÉ LORS DES OPÉRATIONS DE COUPE ET DE SOUDAGE À L'ARC ET AU GAZ, disponible auprès du Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402
4. Norme ANSI Z87.1, PRATIQUES SURES POUR LA PROTECTION DES YEUX ET DU VISAGE AU TRAVAIL ET DANS LES ECOLES, disponible de l'Institut Américain des Normes Nationales (American National Standards Institute), 1430 Broadway, New York, NY 10018
5. Norme ANSI Z41.1, NORMES POUR LES CHAUSSURES PROTECTRICES, disponible auprès de l'American National Standards Institute, 1430 Broadway, New York, NY 10018
6. Norme ANSI Z49.2, PRÉVENTION DES INCENDIES LORS DE L'EMPLOI DE PROCÉDÉS DE COUPE ET DE SOUDAGE, disponible auprès de l'American National Standards Institute, 1430 Broadway, New York, NY 10018
7. Norme A6.0 de l'Association Américaine du Soudage (AWS), LE SOUDAGE ET LA COUPE DE CONTENEURS AYANT RENFERMÉ DES PRODUITS COMBUSTIBLES, disponible auprès de la American Welding Society, 550 N.W. LeJeune Rd., Miami, FL 33126
8. Norme 51 de l'Association Américaine pour la Protection contre les Incendies (NFPA), LES SYSTEMES À GAZ AVEC ALIMENTATION EN OXYGENE POUR LE SOUDAGE, LA COUPE ET LES PROCÉDÉS ASSOCIÉS, disponible auprès de la National Fire Protection Association, Batterymarch Park, Quincy, MA 02269

9. Norme 70 de la NFPA, CODE ELECTRIQUE NATIONAL, disponible auprès de la National Fire Protection Association, Batterymarch Park, Quincy, MA 02269

10. Norme 51B de la NFPA, LES PROCÉDÉS DE COUPE ET DE SOUDAGE, disponible auprès de la National Fire Protection Association, Batterymarch Park, Quincy, MA 02269

11. Brochure GCA P-1, LA MANIPULATION SANS RISQUE DES GAZ COMPRIMÉS EN CYLINDRES, disponible auprès de l'Association des Gaz Comprimés (Compressed Gas Association), 1235 Jefferson Davis Highway, Suite 501, Arlington, VA 22202

12. Norme CSA W117.2, CODE DE SÉCURITÉ POUR LE SOUDAGE ET LA COUPE, disponible auprès de l'Association des Normes Canadiennes, Standards Sales, 178 Rexdale Boulevard, Rexdale, Ontario, Canada, M9W 1R3

13. Livret NWSA, BIBLIOGRAPHIE SUR LA SÉCURITÉ DU SOUDAGE, disponible auprès de l'Association Nationale de Fournitures de Soudage (National Welding Supply Association), 1900 Arch Street, Philadelphia, PA 19103

14. Norme AWSF4.1 de l'Association Américaine de Soudage, RECOMMANDATIONS DE PRATIQUES SURES POUR LA PRÉPARATION À LA COUPE ET AU SOUDAGE DE CONTENEURS ET TUYAUX AYANT RENFERMÉ DES PRODUITS DANGEREUX , disponible auprès de la American Welding Society, 550 N.W. LeJeune Rd., Miami, FL 33126

15. Norme ANSI Z88.2, PRATIQUES DE PROTECTION RESPIRATOIRE, disponible auprès de l'American National Standards Institute, 1430 Broadway, New York, NY 10018

1.07 Declaration of Conformity

Manufacturer: Thermal Dynamics Corporation
Address: 82 Benning Street
West Lebanon, New Hampshire 03784
USA

The equipment described in this manual conforms to all applicable aspects and regulations of the 'Low Voltage Directive' (European Council Directive 73/23/EEC as amended by Council Directive 93/68/EEC) and to the National legislation for the enforcement of this Directive.

The equipment described in this manual conforms to all applicable aspects and regulations of the "EMC Directive" (European Council Directive 89/336/EEC) and to the National legislation for the enforcement of this Directive.

Serial numbers are unique with each individual piece of equipment and details description, parts used to manufacture a unit and date of manufacture.

National Standard and Technical Specifications

The product is designed and manufactured to a number of standards and technical requirements. Among them are:

* CSA (Canadian Standards Association) standard C22.2 number 60 for Arc welding equipment.

* UL (Underwriters Laboratory) rating 94VO flammability testing for all printed-circuit boards used.

* CENELEC EN50199 EMC Product Standard for Arc Welding Equipment.

* ISO/IEC 60974-1 (BS 638-PT10) (EN 60 974-1) (EN50192) (EN50078) applicable to plasma cutting equipment and associated accessories.

* For environments with increased hazard of electrical shock, Power Supplies bearing the S mark conform to EN50192 when used in conjunction with hand torches with exposed cutting tips, if equipped with properly installed standoff guides.

* Extensive product design verification is conducted at the manufacturing facility as part of the routine design and manufacturing process. This is to ensure the product is safe, when used according to instructions in this manual and related industry standards, and performs as specified. Rigorous testing is incorporated into the manufacturing process to ensure the manufactured product meets or exceeds all design specifications.

Thermal Dynamics has been manufacturing products for more than 30 years, and will continue to achieve excellence in our area of manufacture.

Manufacturers responsible representative: Steve Ward
Operations Director
Thermadyne Europe
Europa Building
Chorley N Industrial Park
Chorley, Lancashire,
England PR6 7BX

CE

1.08 Statement of Warranty

LIMITED WARRANTY: Subject to the terms and conditions established below, Thermal Dynamics® Corporation warrants to the original retail purchaser that new Thermal Dynamics CUTMASTER™ 1Series plasma cutting systems sold after the effective date of this warranty are free of defects in material and workmanship. Should any failure to conform to this warranty appear within the applicable period stated below, Thermal Dynamics Corporation shall, upon notification thereof and substantiation that the product has been stored operated and maintained in accordance with Thermal Dynamics' specifications, instructions, recommendations and recognized industry practice, correct such defects by suitable repair or replacement.

T**his warranty is exclusive and in lieu of any warranty of merchantability or fitness for a particular purpose.**

Thermal Dynamics will repair or replace, at its discretion, any warranted parts or components that fail due to defects in material or workmanship within the time periods set out below. Thermal Dynamics Corporation must be notified within 30 days of any failure, at which time Thermal Dynamics Corporation will provide instructions on the warranty procedures to be implemented.

Thermal Dynamics Corporation will honor warranty claims submitted within the warranty periods listed below. All warranty periods begin on the date of sale of the product to the original retail customer or 1 year after sale to an authorized Thermal Dynamics Distributor.

LIMITED WARRANTY PERIOD

Product	Power Supply Components (Parts and Labor)	Torch and Leads (Parts and Labor)
CUTMASTER™ 51	3 Years	1 Year
CUTMASTER™ 81	3 Years	1 Year
CUTMASTER™ 101	3 Years	1 Year

This warranty does not apply to:

1. Consumable Parts, such as tips, electrodes, shield cups, o - rings, starter cartridges, gas distributors, fuses, filters.
2. Equipment that has been modified by an unauthorized party, improperly installed, improperly operated or misused based upon industry standards.

In the event of a claim under this warranty, the remedies shall be, at the discretion of Thermal Dynamics Corporation:

1. Repair of the defective product.
2. Replacement of the defective product.
3. Reimbursement of reasonable costs of repair when authorized in advance by Thermal Dynamics.
4. Payment of credit up to the purchase price less reasonable depreciation based on actual use.

These remedies may be authorized by Thermal Dynamics and are FOB West Lebanon, NH or an authorized Thermadyne service station. Product returned for service is at the owner's expense and no reimbursement of travel or transportation is authorized.

LIMITATION OF LIABILITY: Thermal Dynamics Corporation shall not under any circumstances be liable for special or consequential damages such as, but not limited to, damage or loss of purchased or replacement goods or claims of customer of distributors (hereinafter "Purchaser") for service interruption. The remedies of the Purchaser set forth herein are exclusive and the liability of Thermal Dynamics with respect to any contract, or anything done in connection therewith such as the performance or breach thereof, or from the manufacture, sale, delivery, resale, or use of the goods covered by or furnished by Thermal Dynamics whether arising out of contract, negligence, strict tort, or under any warranty, or otherwise, shall not, except as expressly provided herein, exceed the price of the goods upon which liability is based.

This warranty becomes invalid if replacement parts or accessories are used which may impair the safety or performance of any Thermal Dynamics product.

This warranty is invalid if the Thermal Dynamics product is sold by non - authorized persons.

Effective May 23, 2005

SECTION 2: INTRODUCTION

2.01 Scope Of Manual

This manual provides service instructions for Thermal Dynamics CutMaster™ 81 Plasma Cutting Power Supply. Information in this manual is particularly applicable to the troubleshooting and repair of this power supply, and is intended for use by properly-trained service technicians familiar with this equipment.

For setup of this equipment, individual operating procedures, and basic troubleshooting, refer to Operating Manual (0-2956).

Read both the operating manual and the service manual thoroughly. A complete understanding of the capabilities and functions of this equipment will assure obtaining the performance for which it was designed.

The CutMaster™ 81 Power Supply is available for the following input voltages:

- 208/230-Volt Single-Phase
- 400-Volt Three-Phase
- 415-Volt Three Phase
- 460-Volt Three-Phase
- 600-Volt Three-Phase

The 460-Volt Three-Phase unit may be converted for Single-Phase input power with a change of input power cord.

This Service Manual covers all types. Particular attention is required in the Trouble-Shooting Section (Section 4) to ensure that the technician selects the proper test points and measurements for the Power Supply being serviced.

2.02 General Service Philosophy

Several key points are essential to properly support the application and operation of this equipment.

A. Application

The equipment should satisfy the customer's requirements as supplied and as described in Section 3 of this manual. Be sure to confirm that the equipment is capable of the application desired.

B. Modifications

No physical or electrical modifications other than selection of standard options and Accessories are to be made to this equipment.

C. Customer/Operator Responsibilities

It is the customer/operator's responsibility to maintain the equipment and peripheral accessories provided by Thermal Dynamics in good operating order in accordance with the procedures outlined in the operating manual, and to protect the equipment from accidental or malicious damage.

D. Repair Restrictions

The electronics consists of Printed Circuit Board (PCB) Assemblies which must be carefully handled and must be replaced as units. No replacement of printed circuit solder-mounted components is allowed except as noted in this manual.

Printed Circuit Board Assemblies to be returned must be properly packaged in protective material and returned intact per normal procedures.

2.03 Service Responsibilities

The service technician should be familiar with the equipment and its capabilities and should be prepared to recommend arrangements of components which will provide the most efficient layout, utilizing the equipment to its best possible advantage.

Maintenance work should be accomplished in a timely manner. If problems are encountered, or the equipment does not function as specified, contact the Technical Services Department at West Lebanon, NH for assistance (1-603-298-5711).

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SECTION 3: DESCRIPTION

3.01 Scope

The purpose of this section is:

- To familiarize the service technician with the capabilities and limitations of the equipment;
- To provide an overall understanding which will allow the technician, in turn, to properly train customer operating personnel.

The power supply includes all control circuitry, electrical and air inputs and outputs, pilot circuitry, work cable with clamp, and input power cable.

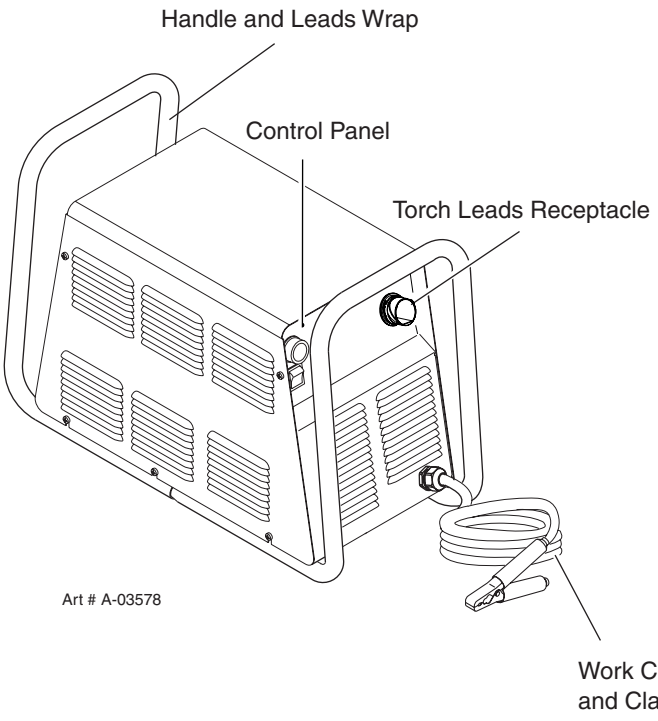
3.02 Power Supply Specifications

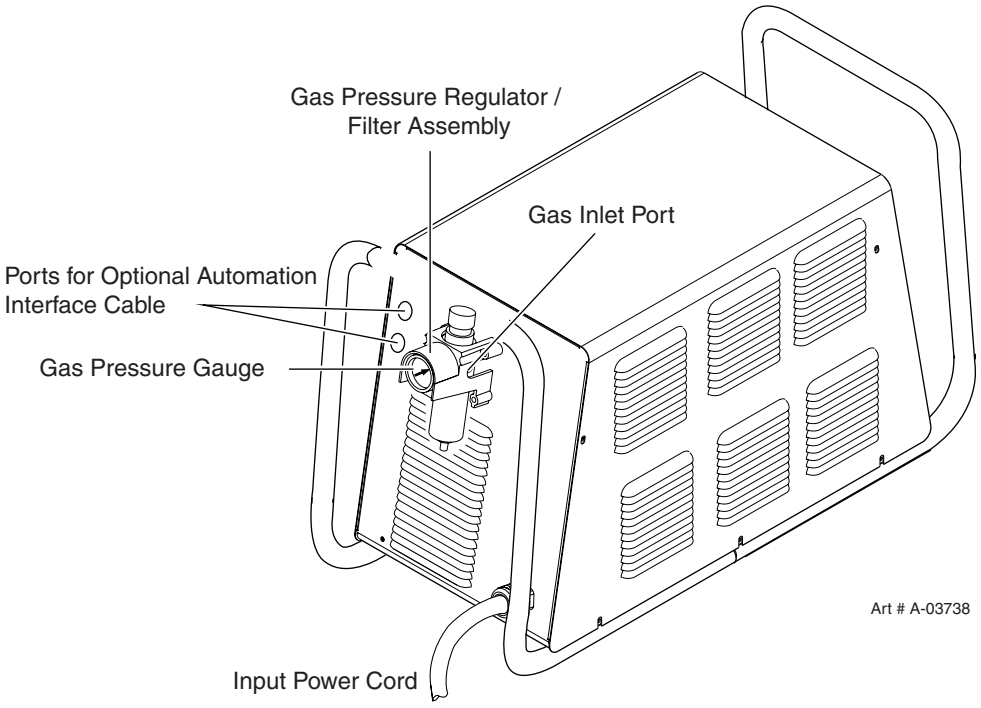
CutMaster 81 Power Supply Specifications							
Input Power	208 / 230 VAC (187 - 253 VAC), Single Phase, 50/60 Hz						
	400 VAC (360 - 440 VAC), Three Phase, 50/60 Hz						
	415 VAC (370 - 460 VAC), CE Three Phase, 50 Hz						
	460 VAC (414 - 506 VAC), Single Phase, 60 Hz						
	460 VAC (414 - 506 VAC), Three Phase, 60 Hz						
	600 VAC (517 - 632 VAC), Three Phase, 60 hz						
Input Power Cable	Cable for 208/230 VAC unit includes plug.						
Output Current	20 - 60 Amps, Continuously Adjustable						
Power Supply Gas Filtering Ability	Particulates to 20 Microns						
CutMaster 81 Power Supply Duty Cycle*							
Ambient Temperature	40° C (104° F)						
		IEC Rating	TDC Rating	IEC Rating	TDC Rating	IEC Rating	TDC Rating
208/230V and 460V Units	Duty Cycle	**50%**		**60%**		**100%**	
	Current	60A	60A	60A	60A	45A	45A
	DC Voltage	104V	109V	104V	109V	98V	98V
400V and 415V Units	Duty Cycle	**50%**		**60%**		**100%**	
	Current	60A	n/a	60A	n/a	45A	n/a
	DC Voltage	104V	n/a	104V	n/a	98V	n/a
600V Units	Duty Cycle	**50%**		**60%**		**100%**	
	Current	60A	60A	60A	60A	43A	43A
	DC Voltage	104V	109V	104V	109V	97V	97V
* NOTE: The duty cycle will be reduced if the primary input power (AC)							

NOTE:

IEC Rating is determined as specified by the International Electro-Technical Commission. These specifications include calculating an output voltage based upon power supply rated current. To facilitate comparison between power supplies, all manufacturers use this output voltage to determine duty cycle.

TDC Rating is determined using an output voltage representative of actual output voltage during cutting with a TDC torch. This voltage may be more or less than IEC voltage, depending upon choice of torch, consumables, and actual cutting operation.


Handle and Leads Wrap
Control Panel
Torch Leads Receptacle
Art # A-03578
Work Cable
and Clamp


Gas Pressure Regulator /
Filter Assembly
Gas Inlet Port
Ports for Optional Automation
Interface Cable
Gas Pressure Gauge
Art # A-03738
Input Power Cord

1. Front Panel Controls and Features

- Main Power ON / OFF Switch
- RUN /RAPID AUTO RESTART SET Switch
- Output Current Control (**A**) Sets output current for drag cutting (up to 40 Amps for drag cutting, with the torch tip in contact with the workpiece, or for standoff cutting (up to 60 amps).

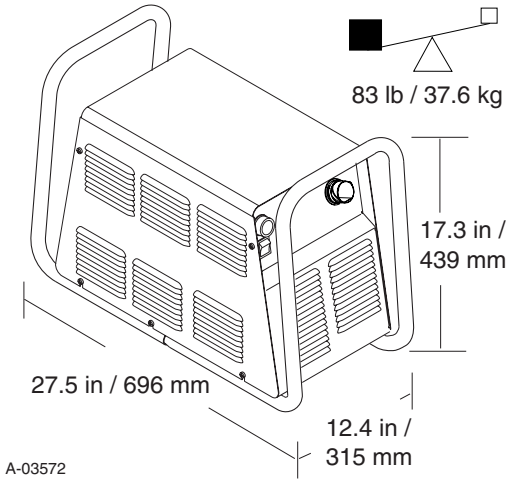
2. Front Panel Indicators

- AC When lighted, indicates AC input power is present in thepower supply.
- TEMP When lighted, indicates the power supply is overheated.
- GAS When lighted, indicates that adequate input air pressure for power supply operation is present.
- DC When lighted, indicates that power supply output circuits are active.

NOTE

Minimum pressure for power supply operation is lower than minimum pressure for torch operation.

3. Dimensions and Weight



3.03 Air Regulator/Filter Assembly Specifications

The following specifications apply to the Air Regulator/Filter Assembly only:

1. Operating Pressure

65 psi (4.5 bar)

2. Maximum input air supply pressure

125 psi (8.6 bar)

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SECTION 4: TROUBLESHOOTING

4.01 Introduction

This section provides service diagnostics for the CutMaster 81 Power Supply, allowing the Technician to isolate any faulty subassemblies. Refer to Section 5, Repairs & Replacement Procedures, for parts replacement instructions.

Under no circumstances are field repairs to be attempted on Printed Circuit Boards or other subassemblies of this unit. Evidence of unauthorized repairs will void the factory warranty.

NOTE

The troubleshooting contained in this manual is for the Power Supply only. Troubleshooting other parts of the system is covered in the manuals for those products.

4.02 Periodic Inspection & Cleaning Procedures

WARNING

Disconnect primary power and bleed down the system before disassembling the torch, leads, or power supply.

To clean the unit, open the enclosure per procedure in section 5.05-A, Cover Removal, and use a vacuum cleaner to remove any accumulated dirt and dust. The unit should also be wiped clean. If necessary, solvents for cleaning electrical apparatus may be used.

Refer to the Appendix for maintenance schedule and procedures.

4.03 System Theory

A. Logic PC Board Functions

The Logic PC Board controls the timing and sequencing of the system. It monitors gas pressure and power supply internal temperatures, and controls the gas flow. The Logic Board also controls the safety latch circuit.

After the ON/OFF switch is closed on the front panel, the AC Indicator ~ turns on.

The GAS indicator is ON when there is sufficient gas pressure in the power supply to enable power supply operation.

NOTE

Minimum gas pressure for power supply operation is lower than the minimum for torch operation.

When the unit is at "idle" the AC indicator ~ on the Front Panel should be ON. When the torch is activated, the gas begins to flow. After a brief preflow, the INV ON signal is given, and the DC indicator ⎓ on the Front Panel turns ON.

An open circuit voltage of approximately 230 to 300 vdc (depending on input power) is produced when the switching of the IGBTs in the Main PC Board is turned ON by an INV ON signal from the Logic PC Board. A circuit on the Logic PC Board monitors the output voltage. When the output voltage drops below 60 vdc, indicating a problem exists, the Logic PC Board sends a signal which turns OFF the INV ON Enable signal. This happens in less than 50 milliseconds.

When the torch is activated, gas will flow for approximately two seconds before DC is established (indicated on the front panel). Then the gas shuts off briefly. The gas flow then starts again and the torch starts a pilot arc.

When the torch is close to the workpiece, the cutting arc "transfers" to the work.

The resulting current is sensed by the Current Sense circuit, resulting in the demand level changing from pilot current to the main current control setting, and then the main cutting arc starts. If the torch is removed from the workpiece while the torch switch is still pressed, the main arc extinguishes and the pilot arc automatically restarts.

CutMaster 81 Logic Board Indicators	
Indicator	*Meaning*
D13	Inverter ON
D33	Torch Switch ON
D25	Drag Circuit ON

4.04 Common Operating Problems

WARNINGS

Disconnect primary power at the source before disassembling the power supply, torch, or torch leads.

Frequently review the Important Safety Precautions in Section 1. Be sure the operator is equipped with proper gloves, clothing, and eye and ear protection. Make sure no part of the operator's body comes into contact with the workpiece while the torch is activated.

Sparks from the cutting process can cause damage to coated, painted, and other surfaces such as glass, plastic and metal.

Handle torch leads with care and protect them from damage.

A. Piloting

Piloting is harder on parts life than actual cutting because the pilot arc is directed from the electrode to the tip rather than to a workpiece. Whenever possible, avoid excessive pilot arc time to improve parts life.

B. Torch Standoff

Improper standoff (the distance between the torch tip and workpiece) can adversely affect tip life as well as shield cup life. Standoff may also significantly affect the bevel angle. Reducing standoff generally results in a more square cut.

C. Edge Starting

For edge starts, hold the torch perpendicular to the workpiece with the front of the torch tip at the edge of the workpiece, not touching, at the point where the cut is to start. When starting at the edge of the plate, do not pause at the edge and force the arc to "reach" for the edge of the metal. Establish the cutting arc as quickly as possible.

D. Direction of Cut

The plasma gas stream swirls as it leaves the torch. The purpose of the swirl is to maintain a smooth column of gas. The swirl effect results in one side of a cut being more square than the other. Viewed along the direction of travel, the right side of the cut is more square than the left.

E. Dross

When dross is present on carbon steel, it is commonly referred to as either "high speed, slow speed, or top dross". Dross present on top of the plate is normally caused by too great a torch to plate distance. "Top dross" is normally very easy to remove and can often be wiped off with a welding glove. "Slow speed dross" is normally present on the bottom edge of the plate. It can vary from a light to heavy bead, but does not adhere tightly to the cut edge, and can be easily scraped off. "High speed dross" usually forms a narrow bead along the bottom of the cut edge and is very difficult to remove. When cutting a troublesome steel, it is sometimes useful to reduce the cutting speed to produce "slow speed dross". Any resultant cleanup can be accomplished by scraping, not grinding.

F. Parts - In - Place Circuit

The power supply connects to Models SL60 or SL100 Torches. Parts-In-Place circuitry in the power supply checks for the presence of torch consumable parts in the torch head. When the shield cup is properly installed, there is a slight gap between the shield cup and the torch handle. Gas vents through this gap as part of normal operation. Do not attempt to force the shield cup to close this gap. Forcing the shield cup against the torch head or torch handle can damage torch components.

G. Common Cutting Faults

1. Insufficient Penetration

a. Cutting speed too fast

b. Torch tilted too much

c. Metal too thick

d. Worn torch parts

e. Cutting current too low

f. Non-Genuine Thermal Dynamics parts used

2. Main Arc Extinguishes

a. Cutting speed too slow

b. Torch standoff too high from workpiece

c. Cutting current too high

d. Work cable disconnected

e. Worn torch parts

f. Non-Genuine Thermal Dynamics parts used

3. Excessive Dross Formation

a. Cutting speed too slow

b. Torch standoff too high from workpiece

c. Worn torch parts

d. Improper cutting current

e. Non-Genuine Thermal Dynamics parts used

4. Short Torch Parts Life

a. Moisture in air source

b. Exceeding system capability (material too thick)

c. Excessive pilot arc time

d. Gas pressure too low

e. Improperly assembled torch

f. Incorrect torch parts for the operation

g. Non-Genuine Thermal Dynamics parts used

4.05 Troubleshooting Guide - General Information



WARNING

There are extremely dangerous voltage and power levels present inside this unit. Do not attempt to diagnose or repair unless you have had training in power electronics measurement and troubleshooting techniques.

A. General Information

This Section covers advanced troubleshooting, which requires power supply disassembly and live measurements. Advanced troubleshooting and repair of this unit is a process which should be undertaken only by those familiar with high voltage high power electronic equipment.

If major complex subassemblies are faulty, the faulty subassembly must be returned for repair.

NOTE

Follow all instructions as listed and complete each in the order presented.

The troubleshooting guide has subsections as follows:

Section 4.06 - Circuit Fault Isolation

Section 4.07 - Main Input and Internal Power Problems

Section 4.08 - Pilot Arc Problems

Section 4.09 - Main Arc Problems

Section 4.10 - Test Procedures

Subsection 4.10 includes specific test procedures and indicator status identification tables. The subsection is referenced by the troubleshooting guide for the specific test to be performed. The Power Supply is available for several input voltages. The technician must select the proper test points and measurements for the Power Supply being serviced.

B. How to Use the Troubleshooting Guide

The following information is a guide to help the Service Technician determine the most likely causes for various symptoms. This guide is set up in the following manner:

1. Perform operational check(s) on the equipment to isolate problem to possible circuit(s) per Subsection 4.06, Circuit Fault Isolation.
2. Determine symptom and isolate to defective assembly using the following format:

   X. Symptom (Bold Type)

   Any Special Instructions (Text Type)

   1. Cause (Italic Type)

   a. Check/Remedy (Text Type)
3. Locate your **symptom** in the appropriate Subsection.
4. Check the *causes* (easiest listed first) for the **symptom**.
5. Check the remedies listed for each cause.
6. Repair as needed being sure to verify that unit is fully operational after any repairs.

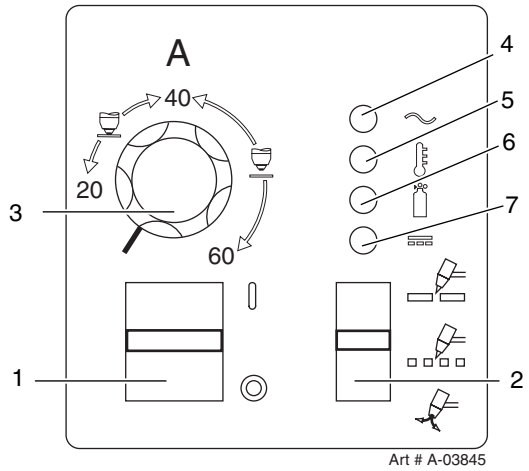
NOTES

Many signals are transferred between Printed Circuit Board Assemblies on Cables. If these cables become faulty they can then cause various problems. ***Do not*** *forget about these cables when troubleshooting.*

While troubleshooting visually inspect the internal components for signs of overheating, fractures and damage.

4.06 Circuit Fault Isolation

A. Controls and Indicators



1. **ON/OFF switch.** This switch controls AC power to the unit. Up is ON, down is OFF.
2. **RUN / RAPID AUTO RESTART / SET switch.** This switch controls gas flow to the torch. Up is RUN, for general torch operation. Center position is RAPID AUTO RESTART, for an uninterrupted restart when cutting expanded metal or in gouging or trimming operations. Down is SET, for setting gas pressure and purging lines.
3. **Current control knob (A)** This control regulates current to the torch. At output settings over 40 amps, circuitry in the power supply automatically reduces output current to 40 amps if the torch tip contacts the workpiece.
4. ~ **AC indicator** When lit, indicates operating power is present in the unit.
5. **TEMP indicator** turns on when internal sensors detect temperatures above normal limits.
6. **GAS indicator** Indicates adequate gas pressure for power supply operation.

   NOTE

   Minimum gas pressure for power supply operation is lower than the minimum for torch operation.

7. ⎓ **DC indicator** Indicates DC power output circuit is active. (Torch must be activated).

B. Initial Setup Conditions

This section is to help isolate the defective circuit before troubleshooting, identify symptoms, and test the unit for proper operation. Follow the instructions as given to identify the possible symptom(s) and the defective circuit. After repairs are complete, run the following tests again to verify that the unit is fully operational.

1. Connect gas supply to rear of Power Supply.
2. Turn on gas supply and set operating pressure per pressure setting label on power supply.

   NOTE

   Minimum gas pressure for power supply operation is lower than the minimum for torch operation.

3. Set the Power Supply controls as follows:
   - ON/OFF switch to OFF (Down)
   - RUN / RAPID AUTO RESTART / SET switch to SET (Down)
   - CURRENT control (**A**) to maximum

C. Main Input and Internal Power Tests

1. Connect main AC power to the unit.
2. Set the Power Supply ON/OFF switch to ON (up) and note the following:
   - AC indicator ~ is steady ON
   - Main PCB Relay energizes, pulling in main input contactor (W1)
   - TEMP Indicator is OFF
   - GAS Indicator is ON if input pressure is sufficient for power supply operation.

     NOTE

     Minimum gas pressure for power supply operation is lower than the minimum for torch operation.

   - DC indicator ⎓ is OFF
   - Gas flows
   - Fans operate
3. Set the Power Supply RUN / RAPID AUTO RESTART / SET switch to the RUN (up) position and note the following:
   - Gas flow stops

This completes the Main Input and Internal Power Tests. If the above are all correct then proceed to paragraph 'D'. If not, note the symptom and proceed to Subsection 4.07, Main Input and Internal Power Problems.

D. Pilot Arc Test

1. Activate the torch (press torch switch on the handle, send START signal from CNC Control, or press the torch switch on the Remote Pendant) to establish a pilot arc and note the following:

   - Gas flows
   - Preflow delay (approximately two seconds) then DC indicator ⎓ turns ON
   - Pilot arc is established

This completes the Pilot Arc Test. If the above are all correct then proceed to paragraph 'E'. If the unit does not function properly, then note the symptom and proceed to Subsection 4.08, Pilot Arc Problems.

E. Main Arc Test

Make sure the work cable is firmly connected to the workpiece. Activate the torch (press torch switch on the handle, send START signal from CNC Control or press the torch switch on the Remote Pendant) to establish a pilot arc.

Bring the torch to within 1/8"-3/8" (3-10 mm) of the workpiece to establish the main cutting arc, and note the following:

- Main cutting arc transfers to workpiece.

This completes the Main Arc Test. If the above are all correct then the equipment should be operating properly. If problems still persist then contact Technical Services.

If the torch does not function as noted then note the symptom and proceed to Subsection 4.09, Main Arc Problems.

4.07 Main Input and Internal Power Problems

A. Opening Power Supply Enclosure

The cover of the Power Supply must be removed for access to input power connections and test points.

WARNING

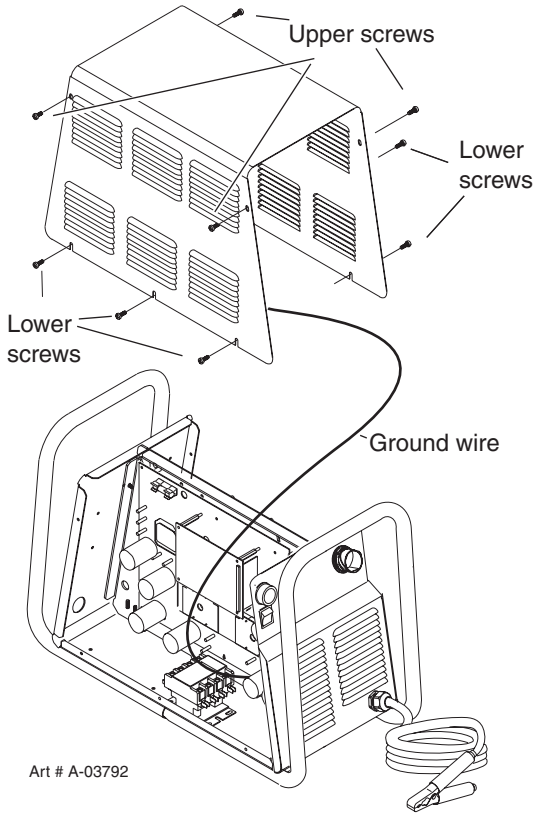
Disconnect primary power at the source before assembling or disassembling the Power Supply, torch parts, or torch and leads assemblies.

1. Remove the upper screws securing the cover to the main assembly.
2. Loosen, but do not remove, the lower screws.

NOTE

There is a ground wire attached from the cover to the main body of the unit.

3. Carefully lift the cover off the unit, and remove the nut securing the ground wire to the side panel.
4. Re-install the cover by reversing the above steps.



Cover Removal

Locate your symptom below:

A. Main power line fuses blow as soon as main disconnect is closed

1. *Input power cable installed incorrectly or defective power cord.*
   a. Check that the input power cable is not defective or installed incorrectly. Section 4.10-D illustrates wiring connections.
2. *Main input contactor (W1) stuck.*
   a. Check contactor. Replace if stuck.

B. Main power line fuses blow immediately after the ON/OFF Switch is turned on.

1. *Faulty Input Diode*
   a. Test Input Diode per Subsection 4.10-C; repair as necessary.

C. Fans do not operate; all control panel indicators OFF

1. *Front Panel ON/OFF switch in OFF position*

   a. Place switch to ON (up) position.

2. *Main power disconnect open*

   a. Close main power disconnect.

3. *Torch is not properly connected to Power Supply.*

   a. Check torch connections to Power Supply. Tighten or adjust as needed.

4. *Shield cup not fully tightened on torch head.*

   a. Check shield cup for proper installation. Do not overtighten.

5. *Main power line fuses blown*

   a. Replace main power line fuses.

6. *Improper input power cable connections inside Power Supply*

   a. Refer to System Schematic and correct if needed.

7. *Defective input power cable*

   a. Replace input power cable.

8. *Fuse blown inside Power Supply*

   a. Replace internal Fuse per Subsection 5.06-A.

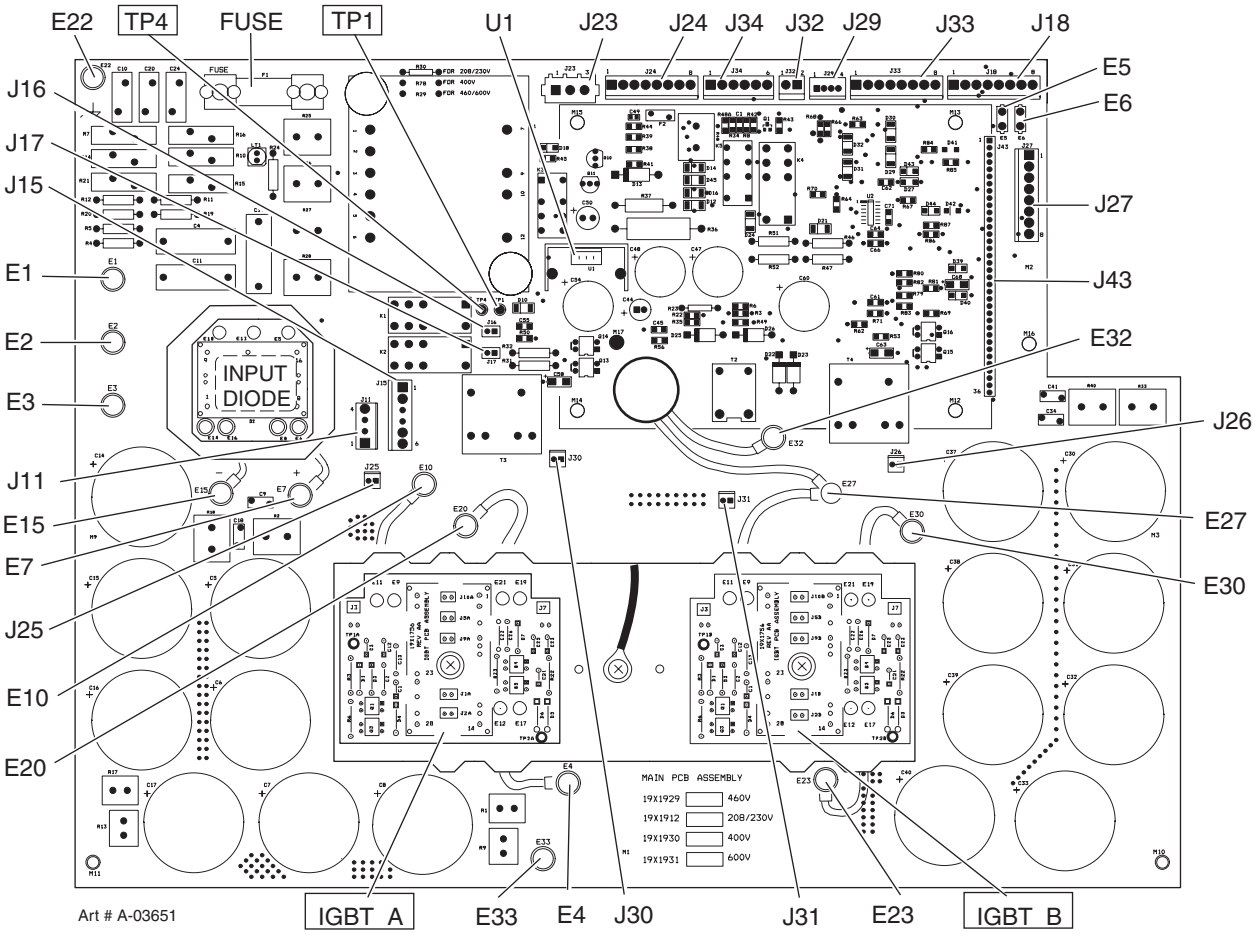
9. *Line voltage above 10% tolerance (over voltage protection)*

   a. Reduce line supply.

10. *Faulty Auxiliary Transformer (refer to Appendix pages, 28 VAC Circuit Diagram)*

    Measure for 28 VAC on Main PC Board from J23-1 to J23-3.

    a. If voltage is not present, replace the Main PC Board.



Main Printed Circuit Board Layout (logic board not shown)

11. Faulty ON/OFF switch

Measure for 28 VAC on the Main PC Board between J18-5 to J18-6.

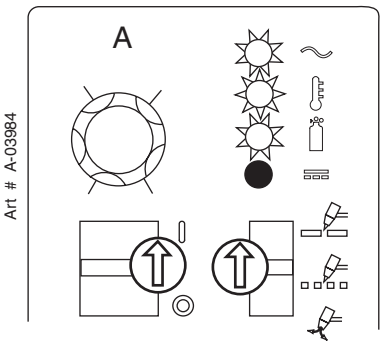
a. If voltage is not present replace the ON/OFF Switch.

12. Faulty Main PC Board

Measure for 12 vdc on Main PC Board from TP4 to TP1.

a. If voltage is not present, replace the Main PC Board.

D. Fans do not run; AC ~, GAS and TEMP indicators ON, DC indicator ⎓ off



1. Air flow through unit is restricted

a. Provide adequate air flow

2. Exceeded Duty Cycle of Power Supply

a. Deactivate torch and wait for fan to cool unit. Refer to Specifications Section for proper duty Cycle for this unit.

3. Faulty Fan(s)

Measure for 230 VAC (±) on the Main PC Board from J15-1 to J15-5, and from J15-2 to J15-6.

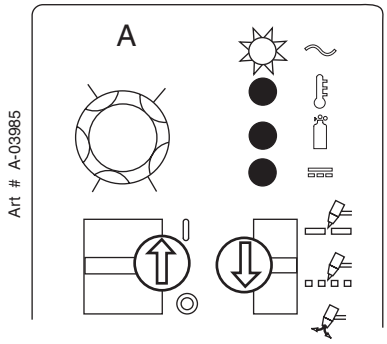
- If voltage at J15-1 to J15-5 is correct, replace lower Fan (M1).
- If voltage at J15-2 to J15-6 is correct, replace upper Fan (M2).

4. Faulty Temperature Sensor / Switch

a. **Shut input power off.** Check IGBT Heatsink Temp Sensor (TS1). Disconnect wire connector P29 from terminal J29 on Main PC Board. Check connector pins 1 and 2 for 10K ohm (±25%) (at ambient temperature). If resistance is not 10K ohm (±25%), replace TS1.

b. **Shut input power off.** Check Inductor Temp Switch (TS2). Disconnect wire connector P32 from terminal J32 on Main PC Board. Check connector pins 1 and 2 for resistance. If resistance is greater than 12K ohms, replace output inductor (L1). If temp switch is open, replace Main PC Board.

E. No gas flow; RUN / RAPID AUTO RESTART /SET switch in SET position; AC indicator ~ ON; TEMP GAS and DC indicators ⎓ OFF



1. Gas supply not connected to unit

a. Connect to gas supply.

2. Gas supply not turned on

a. Turn gas supply on.

3. Gas pressure too low

a. Adjust gas pressure per pressure setting label on power supply.

4. Faulty RUN / RAPID AUTO RESTART / SET switch

a. Check continuity.

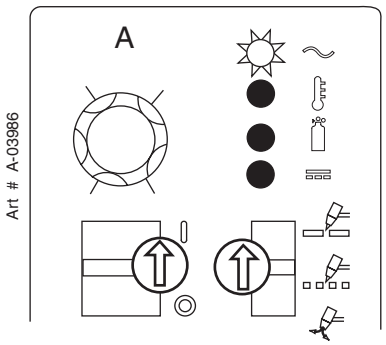
5. Faulty Gas Solenoid circuit

a. Test Gas Solenoid circuit per Subsection 4.10-E; repair as necessary.

6. Faulty Logic Board

a. Replace logic board.

F. RUN / RAPID AUTO RESTART /SET switch in RUN or RAPID AUTO RESTART position; AC indicator ~ ON; TEMP, GAS, and DC indicators ⎓ OFF



1. Gas pressure too low

a. Set operating pressure per pressure setting label on power supply.

2. Faulty Components in Unit

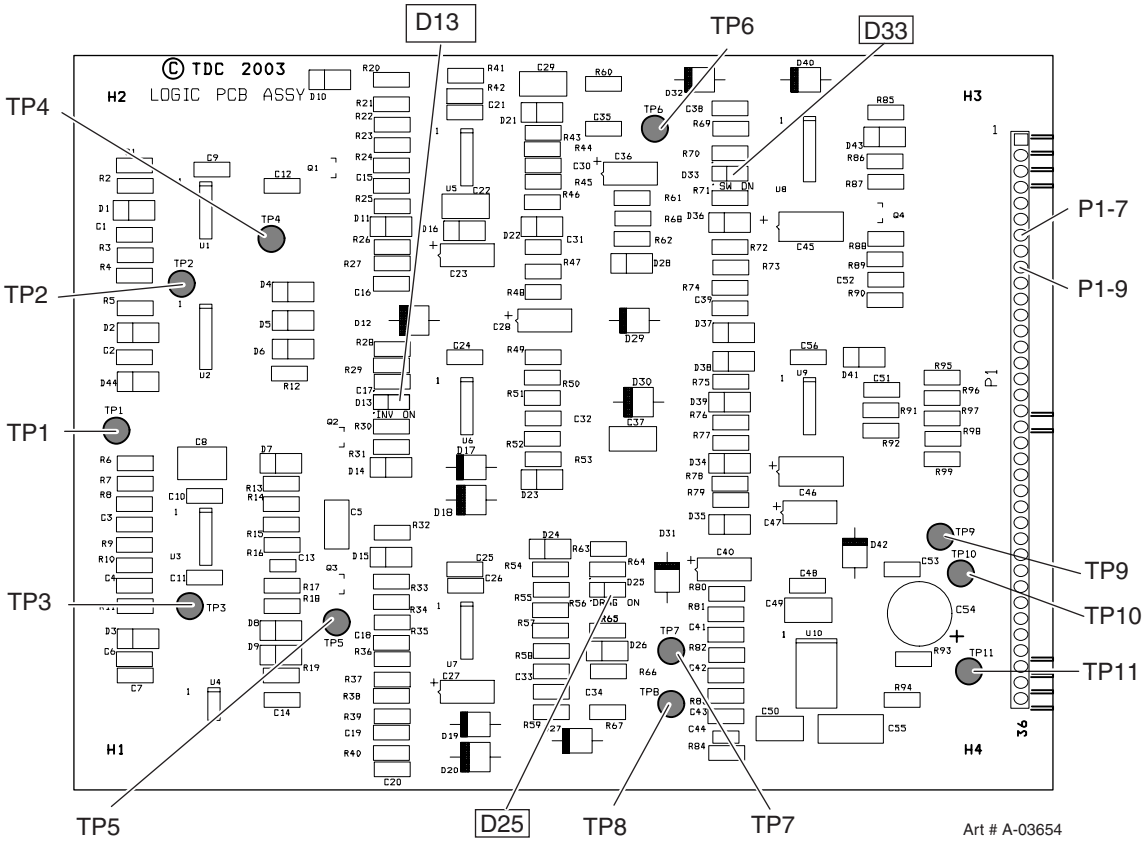
Measure for 12 vdc from wire #10 to wire #11 at the Gas Pressure Switch, located on the right side of the unit.

a. If 12 vdc is present and pressure is above 50 psi (3.4 bar), replace Gas Pressure Switch/Solenoid Assembly. Refer to Section 5.08-A.

b. If pressure is above 50 psi (3.4 bar) and 12 vdc is not present, replace the Logic PC Board.

c. Remove one wire from the pressure switch. Check for ± 0 vdc at Main PC Board pin J24-3 to J24-4 from the Logic PC Board. Refer to Main PC Board Layout.

- If less than a volt, replace Logic PC Board.



Logic Board Layout

G. Gas continues to flow with RUN / RAPID AUTO RESTART / SET switch in RUN position.

1. *Damaged gas solenoid.*

   a. Turn the front panel ON / OFF switch to OFF.

   - If gas continues to flow, debris from the air line is preventing the solenoid from closing. Clean or replace the solenoid.

2. *Faulty RUN / RAPID AUTO RESTART / SET switch.*

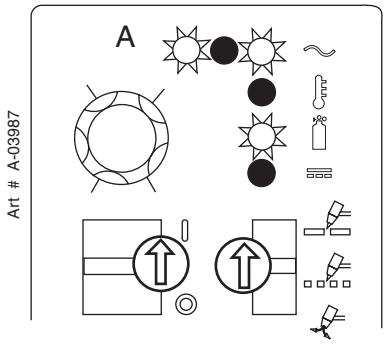
   a. Put switch in SET position. Disconnect wire harness connector from Main PC Board receptacle J18. Check continuity through wire harness sockets 7 and 8. If no continuity, replace switch.

3. *Faulty Logic PCB.*

   a. Measure for approximately 12 vdc between P1-7 and TP-1 on the Logic PCB.

   - If 0 vdc is present, replace Logic PCB.

H. Gas flows continuously when power is turned on; AC indicator ~ flashes, TEMP indicator off, GAS indicator ON, DC indicator ⎓ off



1. *Torch switch is activated (closed) before user turns power on*

   a. Release torch switch, turn power supply OFF, then ON (with torch switch released).

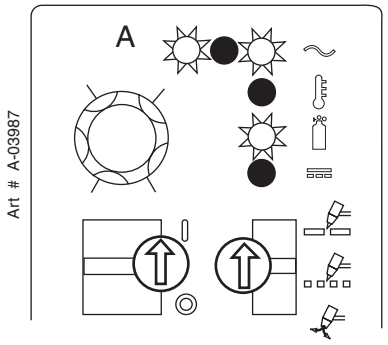
2. *Faulty torch switch*

   a. Turn power supply OFF. Disconnect torch from power supply. Refer to Appendix Pages for Torch Pin-Out Diagrams. Check torch switch continuity through sockets 3 and 4.

NOTE

In mechanized (machine) torch applications, remote pendant control switch must also be closed.

I. Gas cycles on and off when power is turned on; AC indicator ~ flashes; TEMP indicator off, GAS indicator ON



1. *Torch shield cup is loose.*

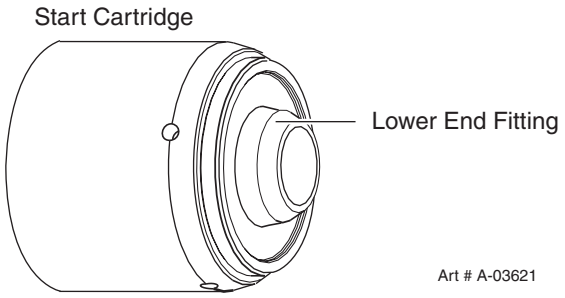
   a. Tighten shield cup by hand. Do not overtighten.

2. *Torch tip, electrode, or starter cartridge missing*

   a. Turn off power supply. Remove shield cup, install missing parts.

3. *Torch starter cartridge is stuck*

   a. Turn off power supply. Bleed down the system. Remove shield cup, tip, and starter cartridge. Check starter cartridge lower end fitting for free movement. Replace cartridge if lower end fitting does not move freely.

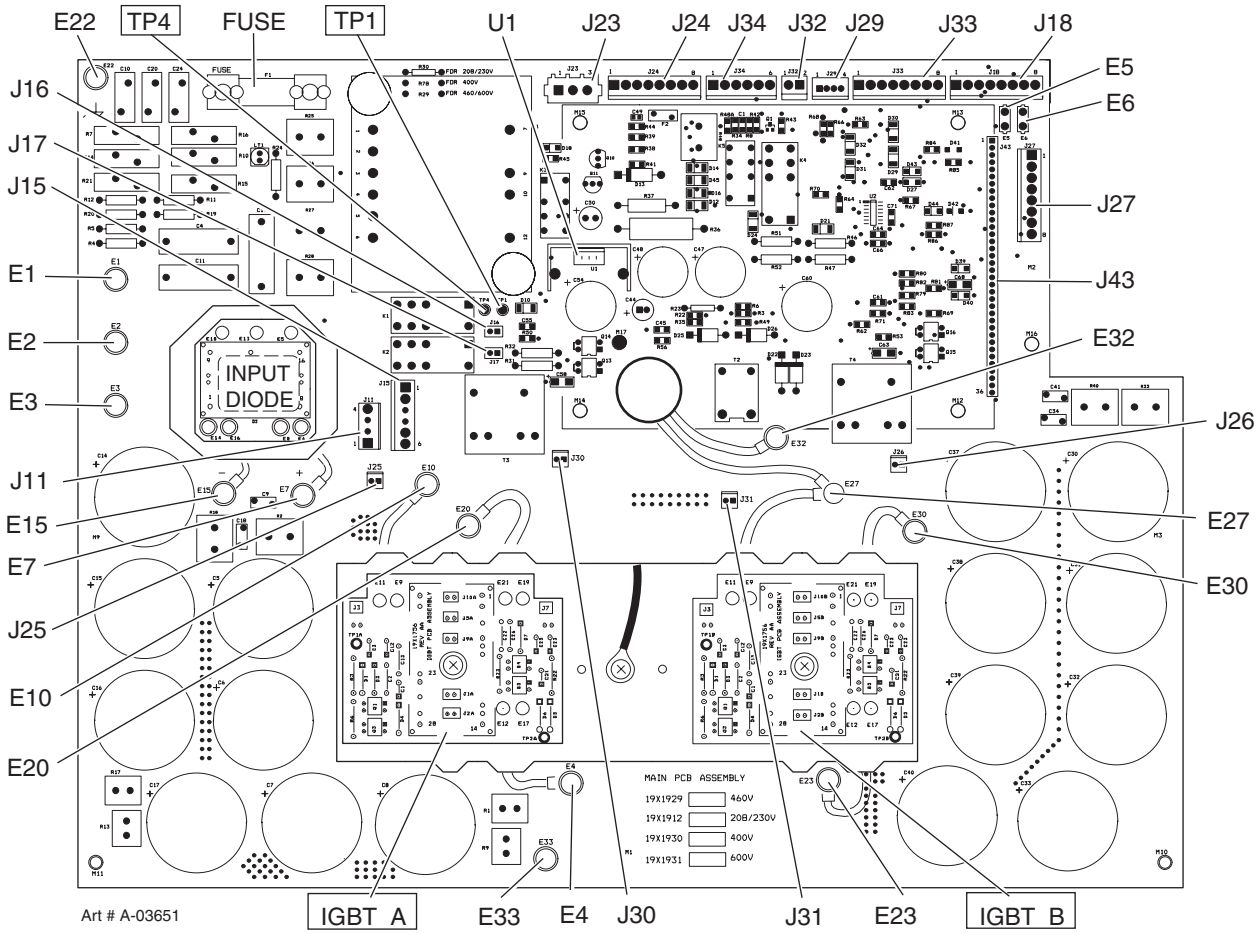


4. *Shorted power supply torch receptacle*

   a. Turn Power Supply OFF. Bleed down the system. Disconnect the torch from the power supply. Check the torch receptacle for continuity between the pilot connection and the negative / plasma connection. Refer to Appendix pages. There should be no continuity.

5. *Shorted output power PC Board.*

   a. Turn Power Supply OFF. Bleed down the system. Refer to Appendix pages, Output Board Wiring Diagram. Check output power PC Board for continuity between terminals E35 and E64. If continuity is found, replace Output Power PC Board.



Main Printed Circuit Board Layout (Logic PCB Not Shown)

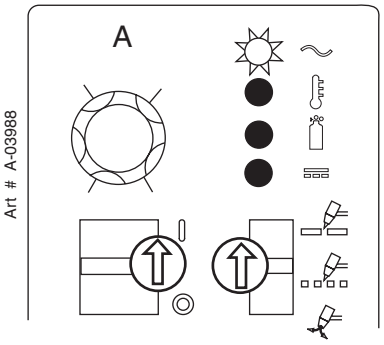
4.08 Pilot Arc Problems

WARNING

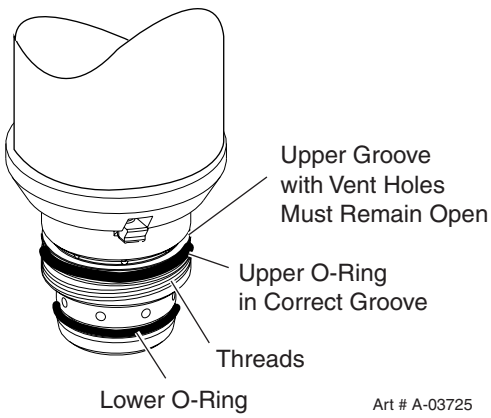
The following tests must be performed with the power supply connected to primary input power. There are extremely dangerous voltage and power levels present inside this unit. Do not attempt to diagnose or repair without proper training in power electronics measurement and troubleshooting techniques.

Locate your symptom below:

A. Torch will not pilot; gas flows; AC indicator ~ ON, GAS, TEMP, and DC indicators ⎓ OFF



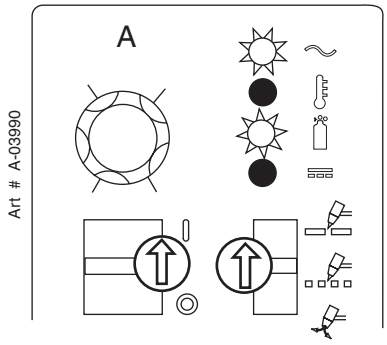
1. *Gas pressure is below power supply minimum requirement*
   a. Adjust gas pressure per pressure setting label on power supply.
2. *Upper O-ring on torch head is in wrong position.*
   a. Remove shield cup from torch; check position of upper O-ring. Correct if necessary.



3. *Faulty IGBT(s)*
   a. Measure between the following points on the IGBTs:
   - IGBT A: E4 to E10
     E10 to E20
   - IGBT B: E23 to E27
     E27 to E30

   Voltage should be approximately 20 vdc before the start signal is active. If voltage measures greater than 100 vdc when the start signal is active, replace the respective IGBT(s).

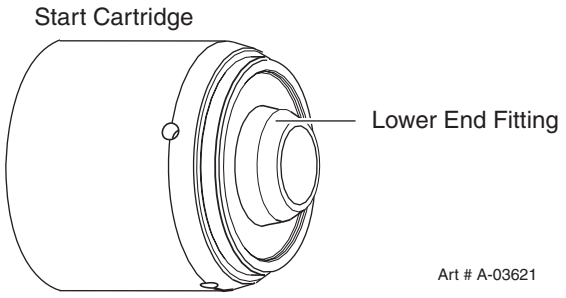
B. Torch will not pilot; RUN / RAPID AUTO RESTART /SET switch in RUN or RAPID AUTO RESTART; AC ~ and GAS indicators ON; Temp and DC ⎓ indicators OFF



1. *Gas pressure is below torch minimum requirement (NOTE: Minimum pressure for power supply operation is lower than minimum required for torch operation.)*
   a. Adjust gas pressure per pressure setting label on power supply.
2. *Torch tip, starter cartridge, or electrode missing.*
   a. Turn off power supply. Remove shield cup, install missing parts.

3. *Torch starter cartridge is stuck*

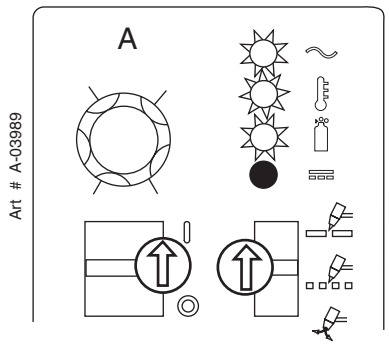
   a. Turn off power supply. Remove shield cup, tip, and starter cartridge. Check lower end fitting on starter cartridge for free movement. Replace cartridge if lower end fitting does not move freely.



4. *Worn or faulty torch parts*

   a. Inspect torch consumable parts. Replace if necessary.

C. Torch will not pilot; AC ~, TEMP, and GAS indicators ON, DC ⎓ indicator off



1. *Air flow blocked*

   a. Check for blocked air flow around the unit and correct condition.

2. *Unit is overheated*

   a. Let unit cool down for at least 5 minutes. Make sure the unit has not been operated beyond Duty Cycle limit. Refer to duty cycle data in Specifications Section.

3. *Input Line Voltage is low*

   a. Check and connect to proper input power line.

4. *Faulty Temperature Sensor / Switch*

CAUTION

Turn off input power for the following tests.

   a. Check IGBT Heatsink Temp Sensor (TS1). Disconnect wire connector P29 from terminal J29 on Main PC Board. Check connector pins 1 and 2 for 10k ohm (± 25%) (at ambient temperature). If resistance is not 10K ohm (±25%), replace TS1.

   b. Check Inductor Temp Switch (TS2). Disconnect wire connector P32 from terminal J32 on Main PC Board. Check connector pins 1 and 2 for at least 12K ohms. If resistance is less than 12K ohms, replace output inductor (L1). If temp switch is open, replace Main PC Board.

5. *Faulty Main PC Board*

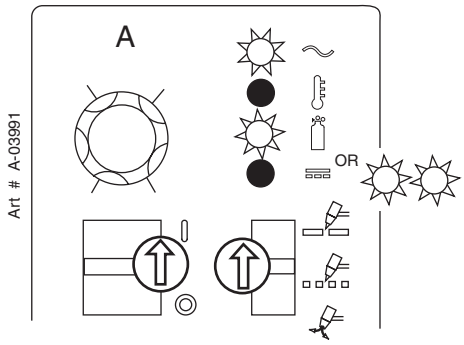
   a. Check for (±) 12 vdc on Main PC Board between TP4 and TP1. If (±) 0 vdc is present, replace Main PC Board.

6. *Faulty Fan(s)*

   Measure for (±) 230VAC on Main PC Board from J15-1 to J15-5, and from J15-2 to J15-6.

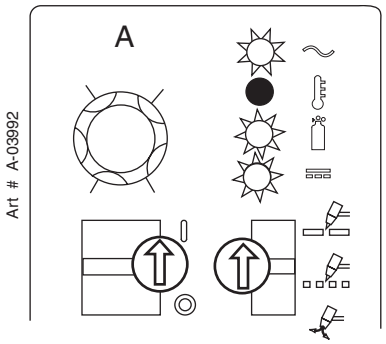
- If voltage at 15-1 to J15-5 is correct, replace upper fan (M1).
- If voltage at 15-2 to J15-6 is correct, replace lower fan (M2).

D. Gas flows; AC indicator ~ and GAS indicators ON; TEMP indicator off; DC indicator ⎓ off or blinks on/off once.



1. *Faulty IGBT or Output Diode Module Assembly(s)*
   a. Check per Subsection 4.10-C; repair as needed.
2. *Faulty Main PCB*
   a. Test per Subsection 4.10-F; repair as needed.

E No arc or intermittent arc in torch; Gas flows; AC ~, GAS and DC ⎓ indicators ON; TEMP indicator off



1. *Gas pressure set incorrectly (too high)*
   a. Reset gas pressure per pressure setting label on power supply.
2. *Oil/moisture in air lines*
   a. Put the ON / OFF switch in the ON (up) position. Put the RUN / RAPID AUTO RESTART / SET switch in the SET (down) position.
   b. Place a welding filter lens in front of the torch and turn on the air. Any oil or moisture in the air will be visible on the lens. **Do not start an arc!**
   c. Purge system. If problem corrected, add filters in line with air source.
3. *Incorrect torch parts*
   a. Inspect the torch parts; replace as needed.
4. *Faulty leads*
   a. Check torch leads continuity.
5. *Faulty torch*
   a. Check torch.
6. *Faulty connection of wire #58 or 62 to Pilot Board*
   a. Check wiring connection. Refer to the System Schematic in the Appendix. Connections should be:
      - Wire #58 to Pilot Board terminal E58
      - Wire #62 to Pilot Board terminal E62

      If wires 58 and 62 are not connected to the proper terminals, replace the Pilot Board.
7. *Faulty Main PC Board*
   a. Check for approximately 12 vdc at TP4 to TP1. If less than 2 vdc, replace the Main PC Board.
8. *Faulty Logic Board or Faulty Pilot Board*
   a. Install a jumper between wires 58 and 62 on Pilot Board and retry piloting. If torch pilots with jumper installed, replace Pilot Board. If torch does not pilot, replace Logic Board.

4.09 Main Arc Problems

Locate your symptom below:

A. Main cutting arc will not start

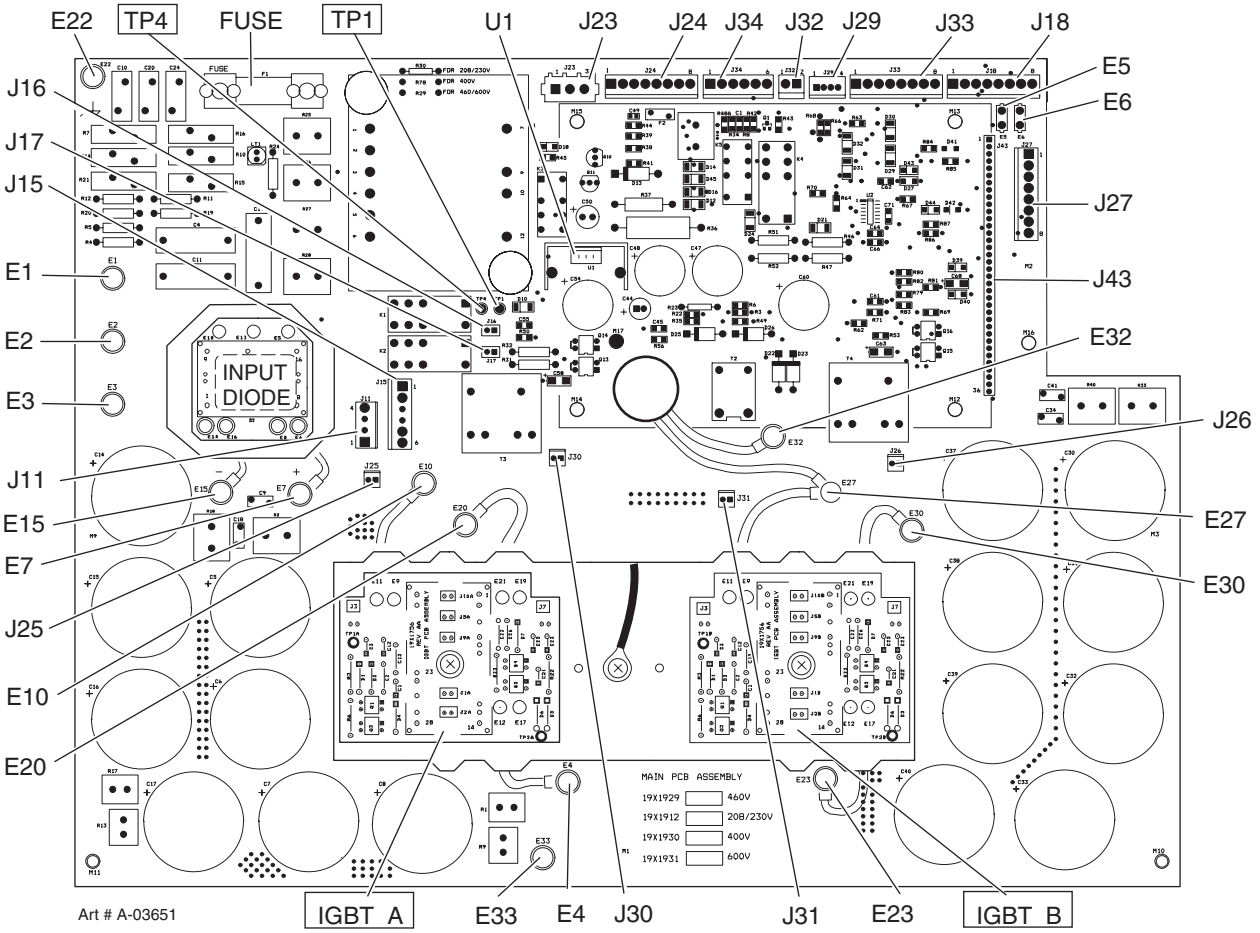
1. *Work cable not connected.*
   a. Connect work cable.
2. *Holding too high of a standoff.*
   a. Refer to recommended standoff heights. Adjust as needed.
3. *Workpiece is painted or rusty.*
   a. Clean workpiece.
4. *Faulty Main PC Board or Logic Board.*
   a. Measure for ±0 vdc at TP2 to TP1 on the Logic Board when attempting to transfer. Refer to Logic Board Layout.
   - If voltage goes to 0 vdc replace Output Board.
   - If not, replace Main PC Board.
5. *Faulty Main Input Contactor.*
   a. Check per Subsection 4.10-D.

B. When operating the amperage drops off after the main cutting arc starts.

1. *Torch tip contacts workpiece*

   Lift the torch tip off the work. At output settings over 40 amps, circuitry in the power supply automatically reduces output current to 40 amps if the torch tip contacts the workpiece.

2. *Faulty Pilot Board*
   a. With power off and wires E58 and E62 disconnected from the pilot board, measure for continuity between terminals #E58 and #E62. If continuity is found, replace Pilot Board.



Main Printed Circuit Board Layout (logic board not shown)

4.10 Test Procedures

The test procedures in this subsection are referenced in the troubleshooting section.

A. Safety Precautions

1. Significant DC Voltage exists after removal of input power. Allow two minutes for discharge time. Voltage measured on input capacitors must be zero before performing service on the power supply.
2. Do Not touch electrical components with any part of the human body when power is applied.
3. Keep away from any moving parts.
4. Hot surfaces can cause severe burns. Allow equipment to cool before servicing.
5. Electrostatic discharge can damage printed circuit board assemblies. Transport printed circuit boards in proper antistatic shielded packages. Use proper grounding techniques with wrist strap before handling printed circuit boards.
6. Misaligned plugs can cause printed circuit board damage. Be sure plugs are properly aligned and completely seated.
7. Excessive pressure can damage printed circuit boards. Use only minimal pressure and gentle movement when disconnecting or connecting printed circuit board plugs.

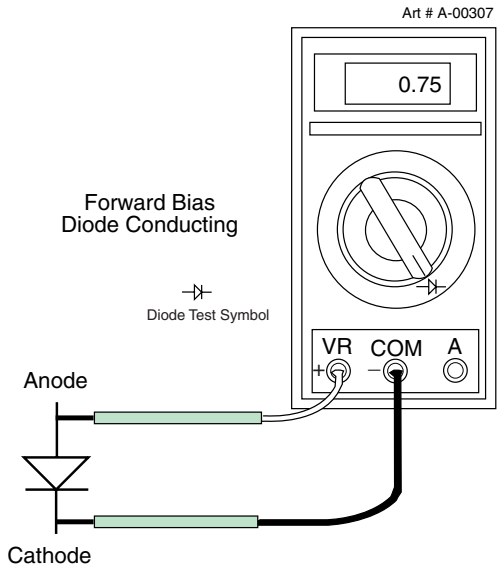
B. Diode Testing Basics

WARNING

Disconnect primary power at the source before disassembling the power supply, torch, or torch leads.

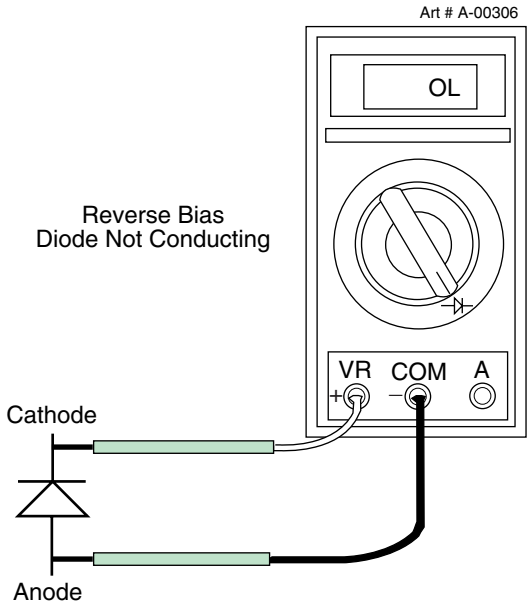
Testing of diode modules requires a digital volt/ohmmeter that has a diode test scale. Remember that even if the diode module checks good, it may still be bad. If in doubt, replace the diode module.

1. Locate the diode module to be tested.
2. Remove cables from mounting studs on diodes to isolate the module.
3. Set digital volt/ohmmeter to diode test scale.
4. Using the Figures for each test, check each diode in the module. Each diode must be checked in forward bias (plus to negative) and reverse bias (negative to plus) direction.
5. Connect the volt/ohmmeter positive lead to the anode (+) of the diode and the negative lead to the cathode (-) of the diode for forward bias testing (refer to following figure). A properly functioning diode will conduct in the forward bias direction and indicate between 0.3 to 0.9 volts.



Testing Diode Forward Bias

6. Reverse the meter leads across the diode for reverse bias testing (refer to following figure). A properly functioning diode will block in the reverse bias direction and depending on the meter function will indicate an open or "OL".



Testing Diode Reverse Bias

7. If a diode checks bad, replace the diode module.
8. Reconnect all cables.

C. Diode Module Board Tests

WARNING

Disconnect primary power at the source before taking any resistance checks.

1. Input Diode Module Board Circuit Test

a. Remove AC power. Refer to Appendix 5-A or 5-B, Main PCB Wiring diagram.

b. Check Input Diode for shorted input diode. With an ohmmeter set on the diode range make the following checks from Main PC Board to Input Diode:

For 400-Volt, 415-Volt, 460-Volt, and 600-Volt Power Supplies:

400V, 415V, 460V, and 600V Input Diode Indications		
Meter +	Meter -	Indication
E15	E1	Diode Drop
E1	E15	Open
E15	E2	Diode Drop
E2	E15	Open
E15	E3	Diode Drop
E3	E15	Open
E7	E1	Open
E1	E7	Diode Drop
E7	E2	Open
E2	E7	Diode Drop
E7	E3	Open
E3	E7	Diode Drop
E7	E15	Open
E15	E7	Diode Drop*
* Indication can be twice other indications.		

For 208/230-Volt Power Supplies:

208/230V Input Diode PCB		
Meter (+)	Meter (-)	Indication
E7	E1	Open
E1	E7	Diode Drop
E15	E1	Diode Drop
E1	E15	Open
E15	E7	Diode Drop *
E7	E15	Open
* Indication can be twice other indications.		

c. The meter should indicate a diode drop in one direction and an open in the other direction for each check. Replace the Input Diode Module Board if the readings do not match the chart.

d. If Input Diode Module Board is shorted, make the following checks with an ohmmeter at the Main Contactor (W1):

Meter (+)	Meter (-)	Indication
L1	T1	Open
L2	T2	Open
L3	T3	Open

If any test has resistance, then replace the Main Contactor.

2. Output Diode Module Board Circuit Test

a. Use an ohmmeter set on the diode function and make the following measurements on the Output Diode Module Boards to Power Output PC Board.

Output Diode A		Output Diode B		Indication
Meter +	Meter -	Meter +	Meter -	
E37	E58	E36	E57	Diode Drop *
E58	E37	E57	E36	Open
E37	E47	E36	E49	Diode Drop
E47	E37	E49	E36	Open
E58	E47	E57	E49	Open
E47	E58	E49	E57	Diode Drop
* Indication can be twice other indications.				

b. The meter should indicate a diode drop in one direction and an open in the other direction for each check. Replace the Output Diode Module Board(s) if the readings do not match the chart.

3. IGBT Module Board Circuit Test

a. Use an ohmmeter set on the diode function and make the following measurements on the IGBT Module Board(s) to the Main PC Board.

IGBT PCB A		IGBT PCB B		Indication
Meter +	Meter -	Meter +	Meter -	
E10	E4	E27	E23	Diode Drop
E4	E10	E23	E27	Open
E10	E20	E27	E30	Open
E20	E10	E30	E27	Diode Drop
E4	E20	E23	E30	Open
E20	E4	E30	E23	Diode Drop *
* Indication can be twice other indications.				

b. The meter should indicate a diode drop in one direction and an open in the other direction for each check. Replace IGBT Module Board(s) if readings are not the same as the chart.

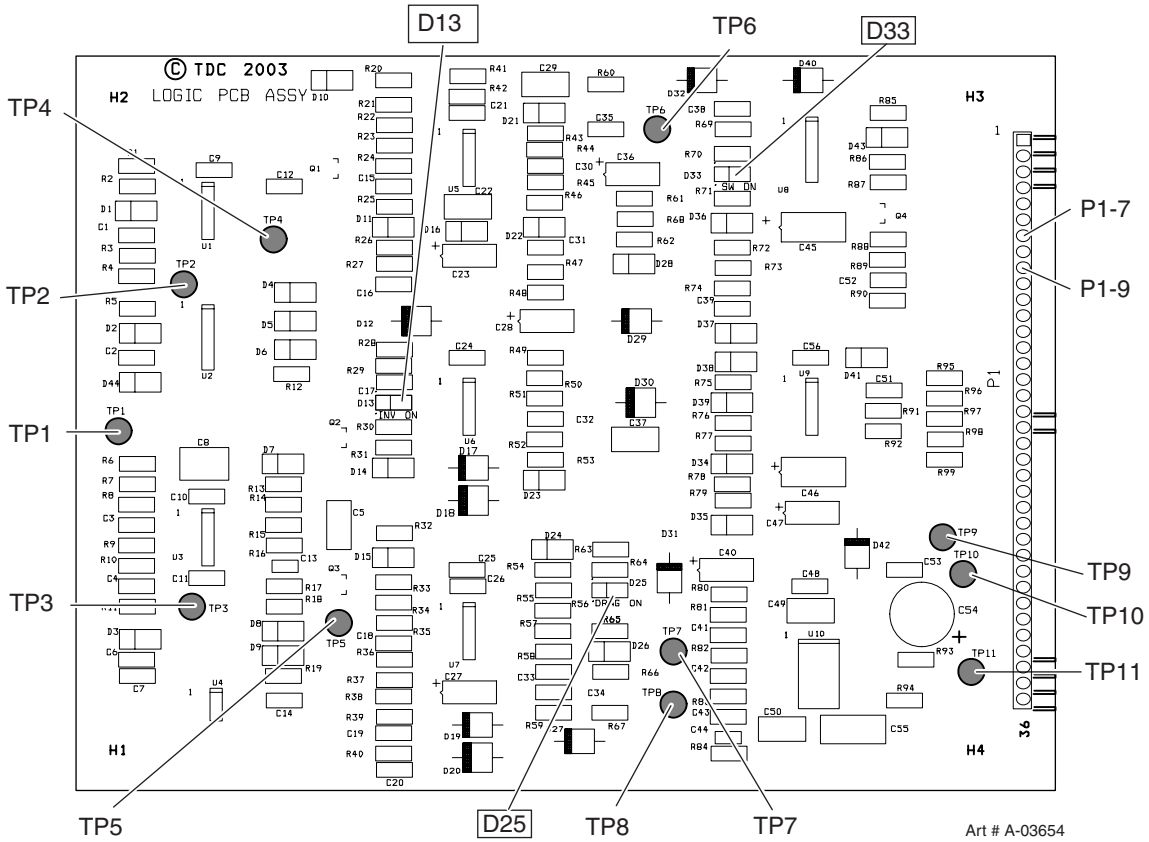
D. Main Input Power Test

WARNING

The following tests must be performed with the power supply connected to primary input power. There are extremely dangerous voltage and power levels present inside this unit. Do not attempt to diagnose or repair without proper training in power electronics measurement and troubleshooting techniques.

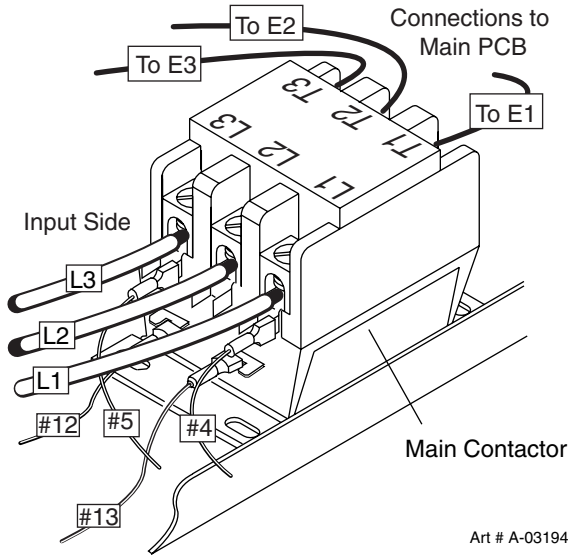
Reconnect power and observe proper start-up procedure. AC indicator ~ on the Front Panel should be ON. If indicator is OFF there is no voltage to the Power Supply or an overvoltage condition exists.

1. If AC indicator ~ on Front Panel is OFF, check for proper AC input voltage between input cables on the Main Contactor. Input voltage should be as shown in the following chart. If not, check for proper voltage at the main power source.

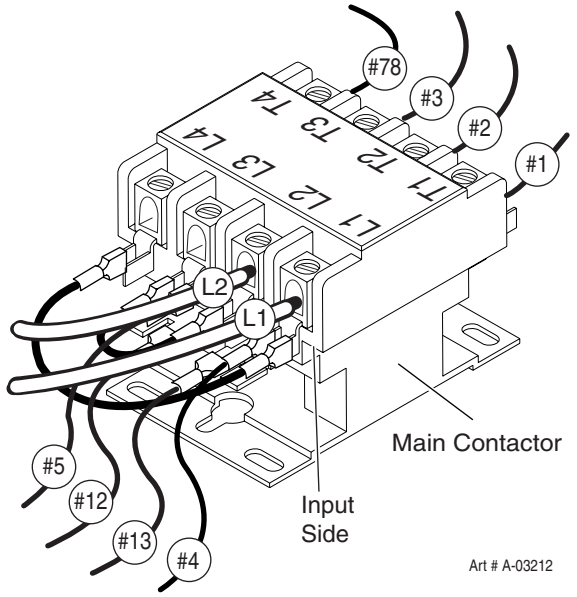


Logic Board Layout

Contactor Voltage Readings		
Nominal Input Voltage	Contactor Points	Voltage Range
208/230VAC	L1, L2	187-253VAC
400VAC	L1, L3	360-440VAC
415VAC	L1, L3	370-460VAC
460VAC	L1, L3	414-506VAC



400 / 415 / 460 / 600-Volt Main Input Contactor (Three-Phase Input Power Shown)



208/230-Volt Main Input Contactor

2. Check for 28 VAC at J23-1 to J23-3 on the Main PC Board.

   a. If greater than 30 VAC, input line power is too high.

   b. If there is no AC power, check the fuse. If the fuse is okay, the auxiliary transformer is faulty. Replace the Main PC Board.

E. Gas Solenoid Circuit Test

Make the following voltage checks and replace the faulty part as required.

1. Place the RUN / RAPID AUTO RESTART / SET Switch to the SET position.
2. Measure for 28 VAC across Solenoid wires #8 and #9. Refer to System Schematic in Appendix Section.
   - If 28 VAC is present, replace Solenoid/Pressure Switch Assembly.
   - If 28 VAC is not present, check for 65 psi (4.5 bar) at the pressure regulator.
3. Check for less than 2 vdc at P1-7 to TP1 on Logic Board.
   - If less than 2 vdc, replace Main PC Board.
   - If more than 2 vdc, replace Logic PC Board.

F. Output Power Tests

1. No DC Output

1. Activate the torch.
   - If INV ON indicator D13 on Logic PC Board does not turn ON, then replace the Logic PCB.
   - If the INV ON indicator D13 blinks ON then OFF immediately, perform the following test:
2. Turn input power OFF, and bleed down the system.
3. Attach a #12 wire jumper between the work lead and terminal E35 or E62 on the Output Power PC Board on the right side of the power supply.
4. Remove the tip and electrode from the torch.

WARNING

The following tests must be performed with the power supply connected to primary input power. There are extremely dangerous voltage and power levels present inside this unit. Do not attempt to diagnose or repair without proper training in power electronics measurement and troubleshooting techniques.

The next step will defeat the safety interlock feature. Proceed with caution.

5. Turn on primary input power and the gas supply. Activate the torch switch. Gas should flow, then stop after 2 seconds. Front panel DC indicator ⎓ should turn on.
6. Measure open circuit voltage between E61(+) to E43 (-) at the Output Power PC Board. Voltage should be greater than 200 V. If voltage is less than 10 V, refer to the diode test measurements in Section 4.10-C.

2. Gate Drive & Sensing

1. Shut off input power. Replace the torch tip and electrode. Remove the jumper betweenthe work lead and terminal E35 or E62 on the Output Power PC Board.
2. Install a jumper between TP1 and TP7 on the Logic Board. Refer to Logic Board layout.
3. When the unit is turned on, the DC light should remain ON.
4. Activate the torch. After two seconds INV ON Indicator (D13) on the Logic PCB should come on and remain on.
   - If INV ON indicator does not remain on, replace Logic PCB.
   - If INV ON indicator remains on, then check for at least 2 vdc between TP-1 to TP-11 and between TP-1 to TP-10 on the Logic PCB. Refer to Logic Board Layout.
     - If no voltage, replace Logic PC Board.
     - If voltage is correct, measure for at least 2 vdc between points as in the following chart:

IGBT A		IGBT B	
E11	J3	E11	J2B
E19	J10A	E19	J10B

     - If voltage is 0, replace Main PCB.

This completes the test procedures.

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SECTION 5: REPLACEMENT PROCEDURES

5.01 Scope

This section describes parts replacement procedures which may be performed on the CutMaster 81 Power Supply.

Under no circumstances are field repairs to be attempted on Printed Circuits or other subassemblies of this unit. Evidence of unauthorized repairs may void the factory warranty.

5.02 Anti-Static Handling Procedures

A. General

Caution: PC Boards can be irreparably damaged by improper handling due to electrostatic discharge (ESD).

Replacement PC Boards are shipped in a protective enclosure to prevent damage from electrostatic discharge (ESD) during shipping. A ground strap is included with each replacement board to prevent static damage during installation.

WARNINGS

Read and understand these instructions and the instructions on the grounding wrist strap package before opening the equipment enclosure or removing the replacement PC board from its protective enclosure.

Disconnect primary power to the system before disassembling the torch, torch leads, or power supply enclosure.

Where these instructions include specific torquing instructions, failure to torque properly will cause component damage.

Do not operate the equipment or test equipment under power while wearing the grounding wrist strap.

B. Procedure

1. Open the wrist strap and unwrap the first two folds of the band. Wrap the adhesive side firmly around your wrist.
2. Unroll the rest of the band and peel the liner from the copper foil at the opposite end.
3. Attach the copper foil to a convenient and exposed electrical ground.
4. Connect the equipment primary cable ground to the same electrical ground as the wrist strap.
5. Open the equipment enclosure and remove the failed PC board.
6. Carefully open the ESD protective bag and remove the replacement PC Board.
7. Install the replacement PC Board in the equipment and make all necessary connections.
8. Place the failed PC Board in the ESD protective bag and seal for return shipping.
9. Replace the power supply cover.
10. Remove the grounding wrist strap from your wrist and from the electrical ground connection before reconnecting primary power to the equipment.

5.03 Parts Replacement - General Information

The parts replacement procedures described in this manual, except for filter replacement, require that the Power Supply be disassembled. The part to be replaced will determine to what extent the Power Supply must be disassembled.

Before removing any connection mark each wire with the connection designation. When reassembling make sure the wires go to the proper terminals.

Note the routing of wires and make sure the wires are put back in the same place when re-assembling the unit.

Each subsection is referenced to Section 6 for parts lists and overall detailed drawings.

WARNING

Disconnect primary power from the source before opening or disassembling the power supply.

Before disassembling any part of the Power Supply first read the procedure for the part to be replaced, then proceed with the disassembly.

5.04 Major External Parts Replacement

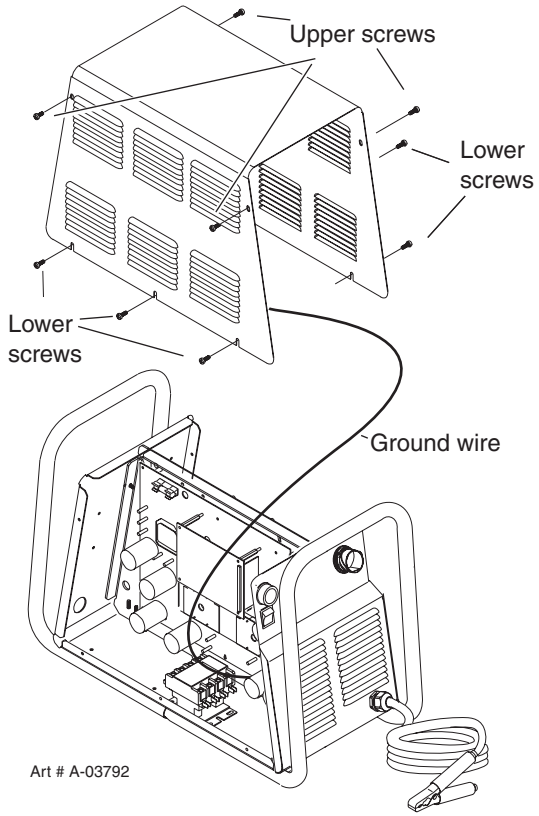
Refer to Section 6.03 for Major External Replacement Parts and overall detailed drawing.

WARNING

Disconnect primary power from the source before opening or disassembling the power supply.

A. Cover Removal and Replacement

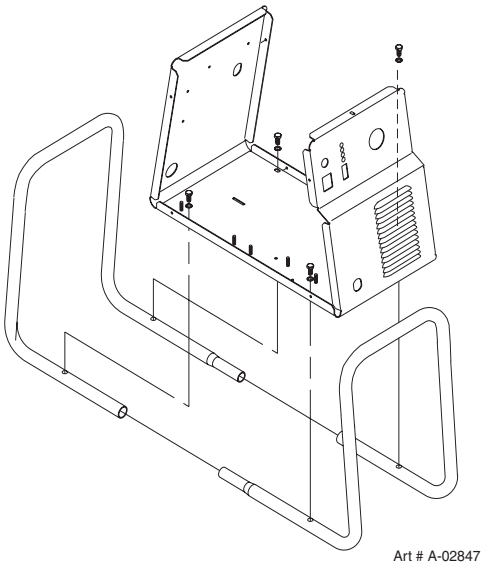
1. Remove the upper screws securing the cover to the unit. Loosen the lower screws securing the cover to the base.



2. Carefully lift the cover up and away from the unit for access to the ground wire connection on the inside of the cover.
3. Remove the nut and washer from the ground stud on the inside of the cover.
4. Install the replacement cover by reversing the above steps.

B. Tube Handle Replacement

1. Remove the cover per subsection 5.04-A.
2. Remove the Fan Assembly Panel per section 5.08-C.
3. Remove the four bolts and star washers securing the frame to the base of the unit.
4. Move the input power cable, torch leads and work cable inside the handle. Lift the base of the unit away from the Tube Handle. Leave the rear panel fastened to the base assembly.
5. With a rubber mallet, separate the two handle ends as shown below.
6. Install the replacement Tube Handle by reversing steps 1-4.
7. Replace the Fan Assembly Panel per section 5.08-C.
8. Re-install the Power Supply cover.



5.05 Front Panel Parts Replacement

Refer to Section 6.04 for Front Panel Replacement Parts and overall detailed drawing.

WARNING

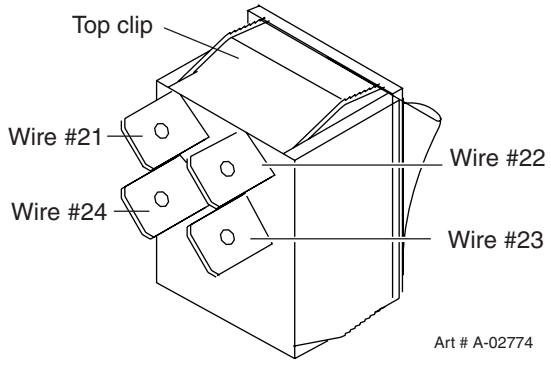
Disconnect primary power from the source before opening or disassembling the power supply.

A. Current (A) Control Knob Replacement

1. Turn the control knob fully clockwise and note the location of the pointer on the knob.
2. Loosen the screw securing the Knob to the potentiometer shaft and remove the Knob.
3. Place the replacement Knob on the potentiometer shaft with the location of the pointer the same as noted in step 1.
4. Tighten the screw to secure the knob to the potentiometer shaft.

B. ON/OFF Switch Replacement

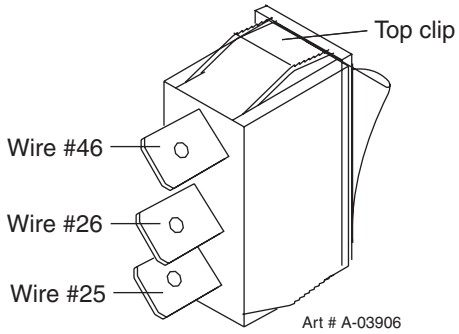
1. Remove the cover per subsection 5.04-A.
2. Disconnect the wires on the rear of the ON/OFF Switch. Note the location of each wire, as shown below:



3. Squeeze together the clips on the top and bottom of the Switch. Remove the Switch through the Front Panel.
4. Install the replacement Switch by reversing the above steps.

C. RUN RAPID AUTO RESTART / SET Switch Replacement

1. Remove the cover per subsection 5.04-A.
2. Disconnect the wires on the rear of the Switch. Note the location of each wire, as shown:



3. Squeeze together the clips on the top and bottom of the Switch, then remove the switch through the Front Panel.
4. Install the replacement Switch by reversing the above steps.

D. POT/LED PC Board Replacement

Follow the antistatic procedures provided in subsection 5.02.

1. Remove the cover per subsection 5.04-A.
2. Remove Current Knob per Subsection 5.05-A.
3. Disconnect wire harness Connector from POT/LED PC Board.
4. Remove PC Board from standoffs.
5. Install the replacement POT/LED PC Board by reversing the above steps.

E. Work Cable Replacement

1. Remove the cover per subsection 5.04-A.
2. Disconnect the Work Cable from the E61 (WORK) terminal on the Power Output PC Board, located on the right side of the unit.
3. Squeeze the top and bottom of the Work Cable Strain Relief and remove from the Front Panel.
4. Remove Work Cable from the unit.
5. Install the replacement Work Cable.
   a. Ensure that the replacement Work Cable passes through the grommet in the Fan Assembly Panel.
   b. Secure the Cable to the Work terminal on the Power Output PC Board and securing the strain relief.

5.06 Left Side Internal Parts Replacement

Refer to subsection 6.05 Left Side Internal Component Replacement Parts and overall detailed drawing.

WARNING

Disconnect primary power from the source before opening or disassembling the power supply.

A. Fuse Replacement

1. Remove the cover per subsection 5.04-A.
2. Locate the Fuse near the top edge of the Main Power PC Board and remove the Fuse from the fuse holder.
3. Install replacement fuse.
4. Reinstall the power supply cover.

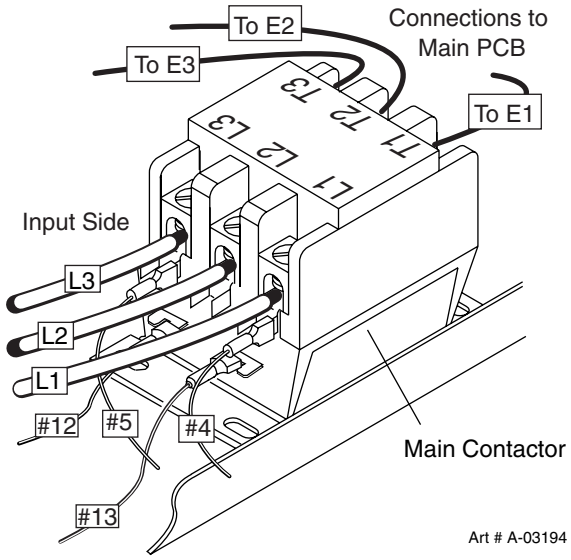
B. Main Input Contactor Replacement

1. Remove the cover per subsection 5.04-A.
2. Label all wires connected to the Input Contactor.
3. Disconnect wires to the Input Contactor from the input cable.
4. Disconnect all other wires connected to the Input Contactor.
5. Remove the two nuts and washers securing the Input Contactor to the base of the power supply.
6. Position the replacement Input Contactor with the row of connectors labeled L toward the rear of the Power Supply. Fasten in place with the hardware removed previously.
7. Complete the wiring connections as shown.

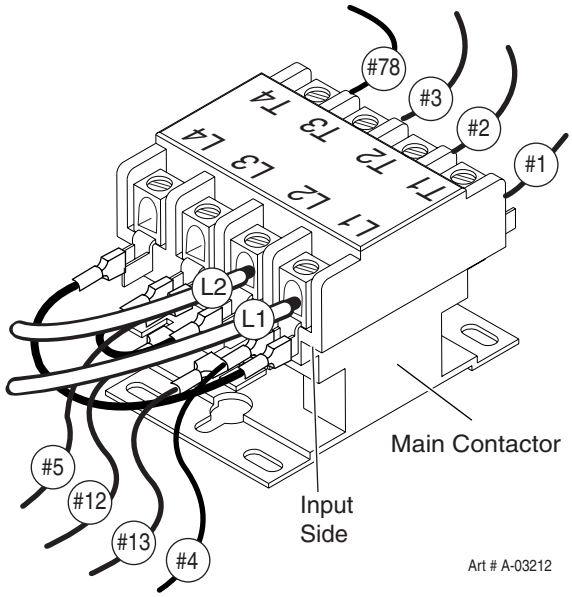
NOTE

It is important that wires are installed correctly, as shown, to prevent damage to the unit.

8. Reinstall the power supply cover.



400-Volt, 415-Volt, 460-Volt, and 600-Volt Input Contactor (3 - phase input power connections shown)



208 / 230-Volt Input Contactor

C. Logic PC Board Replacement

Follow the antistatic procedures in Subsection 5.02. The Logic PC Board connects to the Main PC Board through an extender board perpendicular to both boards.

1. Remove the cover per subsection 5.04-A.
2. Refer to Section 6.05, Left Side Internal Replacement Parts.
3. Remove the bolts in each corner of the Logic PC Board.
4. Detach the Logic PC Board and the extender board from the Main Power PC Board. Detach the extender board from the Logic Board.
5. Install the replacement Logic PC Board by reversing the above steps. The pins on the right edge of the Logic PC Board must fully engage the sockets on the edge of the extender board. The extender board must fully engage sockets on the Main Power PC Board.

D. IGBT Circuit Board or Input Diode Board Replacement

Follow the antistatic procedures in subsection 5.02. The Power Supply includes two IGBT Circuit PC Boards.

NOTE

Follow the electrostatic discharge instructions provided with the replacement component to prevent damage to the component.

Thermal pads, heatsinks, and the large flat surface on the back of diodes and IGBTs must be kept clean. Diodes and IGBTs must not be bent or allowed to pick up any foreign material. A very clean installation between the module and the heatsink or chassis is essential for proper operation.

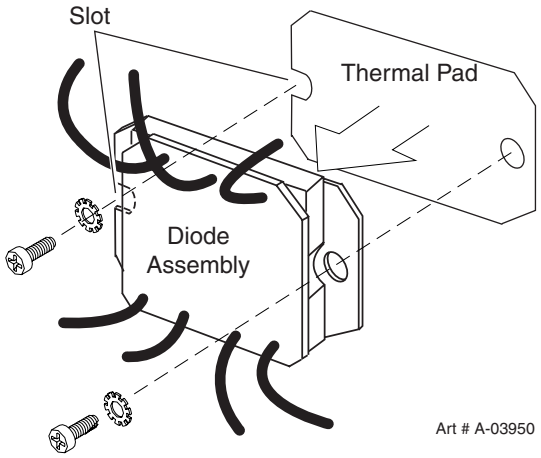
1. Remove cover per subsection 5.04-A.
2. Turn the Power Supply onto its side.
3. Locate the IGBT Circuit PC Boards or Input Diode mounted within the Main Power PC Board. Refer to Appendix pages for location and position.
4. For IGBTs, remove the small jumpers between the IGBT and the Main PC Board. Transfer these jumpers to the replacement IGBT. Label, then remove all other wire connections to the Board(s) being replaced. Note the routing of wires. Ensure that the wires are put back in the same place when installing the replacement module.
5. Remove screw(s) securing PC Board(s) to the heatsink and remove board(s) from the Power Supply.
6. Use isopropyl alcohol and a clean rag to clean the heatsink or chassis area behind the component being replaced. Clean the large flat surface on the back of the replacement component. Do not scratch or abrade the surface.
7. The thermal pad(s), provided with the replacement part, is a thin metal pad. Remove any loose protective paper coverings from the pad(s).

NOTE

Protective coverings must be removed from the thermal pads. Installing thermal pads with protective coverings in place will cause equipment damage or failure.

8. Install replacement components as follows:

For Input Diodes:



Input Diode Replacement

a. Apply the thermal pad to the flat surface of the diode. Align the pad with the rectangular flat surface on the back of the device.

b. Align the diode horizontally, with its longer edges perpendicular to the power supply base.

c. Secure the device and rectangular pad to the chassis with the replacement screws and washers.

9. Torque screw(s) to 35 in-lb. (3.95 Nm).

NOTE

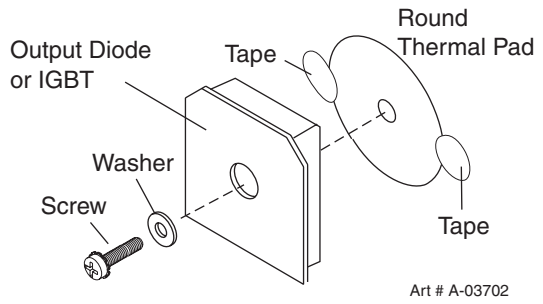
Failure to torque properly will cause component damage.

10. Connect wires per the chart.

CutMaster 81 Input Diode Connections			
208/230V Units		400V, 415V, 460V, 600V Units	
Input Diode	To Main PCB	Input Diode	To Main PCB
E5	E1	E5	E1
E13, E18	E2	E13	E2
		E18	E3
E6, E8	E7	E6, E8	E7
E14, E16	E15	E14, E16	E15

For IGBTs:

a. Apply a round thermal pad to the heatsink with a small piece of light-duty tape. The tape must cover no more than 1/8" (3 mm) of the edge of the thermal pad. Use the screw hole in the heatsink as a guide to position the board.



b. Secure replacement board(s) with the screw removed previously. Ensure that the washer is under the head of the screw.

9. Torque screw(s) to 17 in-lb. (1.9 Nm).

NOTE

Failure to torque properly will cause component damage.

10. Connect wires per the chart.

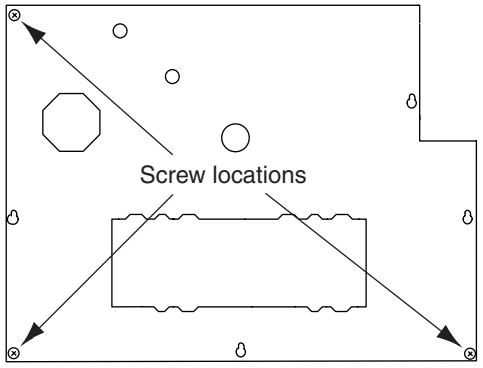
CutMaster 81 IGBT Connections			
IGBT A		IGBT B	
IGBT A Connector	To Main PCB Connector	IGBT B Connector	To Main PCB Connector
J3	J25	J3	J31
J7	J30	J7	J26
E9, E11	E10	E9, E11	E27
E19, E21	E20	E19, E21	E30
E12, E17	E4	E12, E17	E23

11. Stand the unit upright; reinstall the cover.

E. Main Power PC Board Replacement

Follow the antistatic procedures in subsection 5.02.

1. Remove cover per subsection 5.04-A.
2. Remove the Logic PC Board per subsection 5.06-C.
3. Disconnect all wire and cable connections to the Main PC Board. Refer to the Main PC Board Wiring Diagrams in the Appendix Pages if necessary. Straighten the connections to the smaller PC Boards to be perpendicular to the Main PC Board.
5. Remove the two long Transformer screws securing the Transformer to the Center Chassis.
6. Remove the other screws securing the PC Board to the Center Chassis.



7. Carefully remove the original PC Board from the unit.
8. Transfer the Logic PC Board standoffs to the replacement Main PC Board.
9. Install the replacement PC Board by reversing the steps above. It may be easier to install the PC Board if the Power Supply is turned on its right side first. Refer to the charts in subsection 5.06-D for input diode and IGBT wiring connection points.

F. EMI Filter Replacement (CE Units only)

1. Label the input power cable connections and the cable connections to the main input contactor.
2. Disconnect all wire and cable connections to the EMI Filter.
3. Remove the hardware securing the EMI Filter. This hardware passes upward through the base of the power supply.
4. Put the replacement EMI Filter in position and secure it with the hardware removed in Step 3.

5. Connect the input power cables and the cable connections to the main input contactor.
6. Re-install the Power Supply cover.
7. Test the Power Supply for proper operation.

5.07 Rear Panel Parts Replacement

Refer to subsection 6.06 for parts list and overall detailed drawing.



WARNING

Disconnect primary power from the source before opening or disassembling the power supply.

A. Filter/Regulator Assembly Replacement



WARNING

Disconnect the gas supply at the source and bleed down the system before attempting this procedure.

1. Disconnect the gas input hose from the Filter/Regulator Assembly on the Rear Panel of the unit.
2. Remove the four bolts securing the Regulator Mounting Bracket to the Rear Panel.
3. Disconnect the black gas tube from the Filter/Regulator Assembly Adapter Fitting. Hold a wrench or similar tool against the locking ring on the Fitting and pull on the tube to release it.
4. Remove the nut securing the Filter/Regulator Assembly to the Regulator Mounting Bracket. Remove the Filter-Regulator Assembly from the Mounting Bracket.
5. Install the replacement Filter/Regulator Assembly by reversing the steps above. When connecting the gas tube to the Adapter Fitting, simply insert the hose into the fitting until fully seated and it will automatically lock.

B. Filter/Regulator Bracket Replacement

1. Remove the four bolts securing the Regulator Bracket to the Rear Panel.
2. Remove the nut securing the Filter/Regulator Assembly to the Regulator Bracket. Remove the Bracket from the Filter-Regulator Assembly.
3. Install the replacement Bracket by reversing the above steps.

C. Input Power Cable Replacement

1. Remove the cover per subsection 5.04-A.
2. Locate and label the input power cable connections and disconnect the cable.
3. Unthread the retaining nut on the Input Cable Strain Relief on the inside of the Rear Panel and remove the Input Power Cable from the unit.
4. Install the replacement Input Power Cable by reversing the above steps. The Input Power Cable ground wire requires a ring terminal.

D. Rear Panel Replacement



WARNING

Disconnect primary input power and the gas supply at the source and bleed down the system before performing this procedure.

1. Remove the cover per subsection 5.04-A.
2. Remove the primary input power cable per section 5.07-C.
3. Remove the Regulator/Filter Assembly per section 5.07-A.
4. Remove two bolts at the bottom corners of the Rear Panel.
5. Remove one nut on a stud on the inside of the Rear Panel, at the rear edge of the center chassis.
6. Replace the Rear Panel by reversing the above steps.
7. If not already done, attach the data tag(s), provided with the replacement Rear Panel. Position these as on the original Rear Panel.

5.08 Right Side Internal Parts Replacement

Refer to Section 6.07 Right Side Internal Component Parts List and overall detailed drawing.

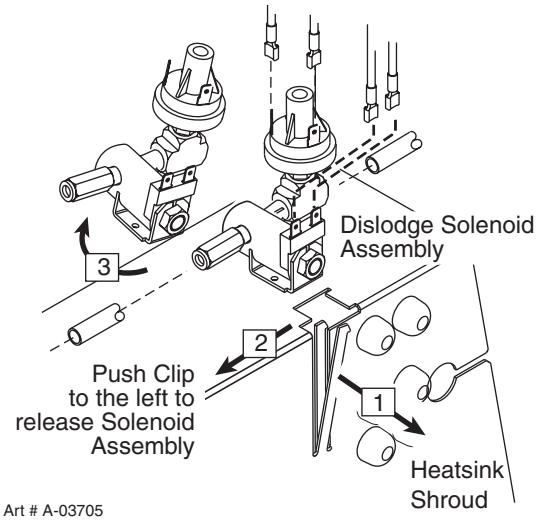
WARNING

Disconnect primary power from the source before opening or disassembling the power supply.

A. Pressure Switch/Solenoid Assembly Replacement

The Pressure Switch and Solenoid Valve are one Assembly. Disconnect primary input power and bleed down the system.

1. Remove the cover per subsection 5.04-A.
2. Disconnect the following wires:
   a. Wires #10 and #11 from the Pressure Switch Assembly.
   b. Wires #8 and #9 from the Solenoid Assembly.
3. Push the clip on the front of the Heatsink Shroud to the left to release the Solenoid Assembly. Dislodge the Assembly from underneath the clip on the top of the Heatsink Shroud.



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4. Release the hose from the Adapter Fitting on the input side of the Solenoid Assembly. Hold a wrench or similar tool against the locking ring on the Fitting, then pull on the hose to release it.
5. Release the hose from the Adapter Fitting on the output side of the Solenoid Assembly.
6. Install the replacement Pressure Switch/Solenoid Assembly by reversing steps 2-5. Once installed, the Solenoid Assembly should fit securely on the Heatsink Shroud. It should not be moveable.
7. Re-install the power supply cover.

B. Pilot PC Board Assembly Replacement

Follow the antistatic procedures in subsection 5.02.

1. Remove the power supply cover per subsection 5.04-A.
2. Label, then disconnect the wiring connections to the Pilot PC Board Assembly.
   a. J28 Connector
   b. Wire connectors to terminals E58 and E62.
3. Remove the bolts securing the PC Board to the standoffs.
4. Slide the PC Board upward to release it from its bottom supports.
5. Install the replacement Pilot PC Board Assembly by reversing the above steps.
6. Reinstall the Power Supply cover.

C. Fan Replacement (M1, M2)

1. Remove the cover per subsection 5.04-A.
2. Label, then carefully remove the wiring connectors from the terminals on the Fans.
3. Disconnect the Work Cable from terminal E61 on the Power Output Board.
4. Remove one bolt from the Front Panel of the Power Supply, near the Control Panel. Pull the Front Panel slightly away from the Power Supply.
5. Remove one nut from a stud at the bottom of the Fan Assembly Panel.
6. Lift the Fan Assembly Panel and pull it out of the Power Supply.

7. Remove two bolts per Fan. Set the Fan(s) aside.
8. Install the replacement Fan Assembly as follows:
   a. Fasten Fan(s) in position with the wiring connectors at the bottom of the Fan(s).

NOTE

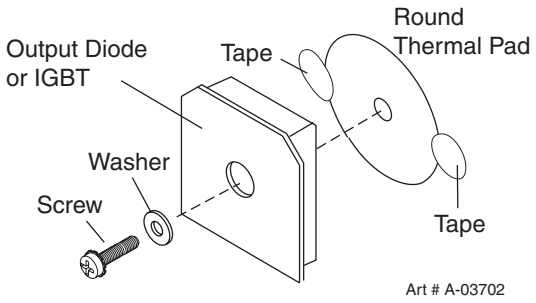
Only two screws are needed to attach the Fan to the Fan Panel. They can be installed in any two holes provided they are opposite each other. For grounding purposes, one of those screws must be installed with a star washer.

   b. Place the Fan Assembly Panel in position in the Power Supply.
      1. The inner edge of the Panel has tabs that engage slots in the center chassis. Ensure that these tabs fully engage in the chassis.
      2. Press the Panel downward. Press the bottom flange fully against the bottom panel of the Power Supply.
      3. Ensure that the hole in the bottom flange of the Fan Assembly Panel engages the mounting stud.
   c. Replace nut on the bottom mounting stud.
   d. Ensure that the Fan Panel's top flange is fully against the top forward edge of the Heatsink Shroud.
   e. Press the front panel of the Power Supply against the Fan Panel, and fasten in place with the bolt removed in Step 2.
   f. Secure the nut on the stud at the bottom of the Fan Panel.
9. Re-connect the wires to the Fan Assemblies.
10. Pass the Work Cable through the hole in the bottom of the Fan Panel. Ensure that the grommet is in place in the hole.
11. Connect the Work Cable to terminal E61 on the Power Output PC Board. Secure the Work Cable Strain Relief.
12. Re-install the Power Supply Cover.

D. Output Diode PC Board Replacement

Follow the antistatic procedures in subsection 5.02.

1. Remove cover per subsection 5.04-A.
2. Locate the Output Diode PCB(s) located within the Output Power PC Board on the right side of the power supply.
3. Carefully remove all wire connections to the Output Diode Board(s).
4. Remove screw(s) securing Output Diode PC Board(s) to the Heatsink and remove board(s) from the Power Supply.
5. Use isopropyl alcohol and a clean rag to clean the heatsink. Do not scratch or abrade the heatsink.
6. Apply the thermal pad provided with the replacement PCB to the heatsink. Secure in place with small pieces of masking tape. The tape must cover no more than 1/4" (6 mm) of the edge of the thermal pad.



7. Use isopropyl alcohol to clean the large flat surface on the back of the component.
8. Secure replacement board as follows:
   a. Position the hardware at the bottom of a recess in the face of the diode. Ensure that the washer is under the head of the screw(s).
   b. Torque hardware to 17 in-lb. (1.9 Nm).

NOTE

Failure to torque properly will cause component damage.

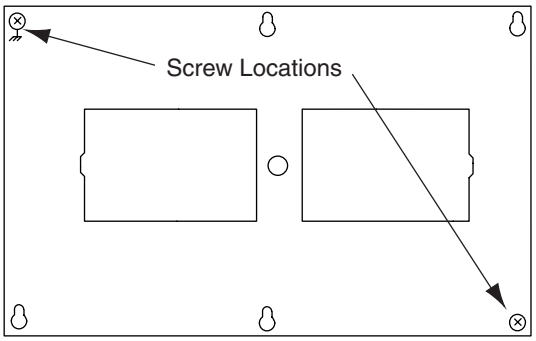
9. Connect wires as follows.

CutMaster 81 Output Diode Connections			
Output Diode A		**Output Diode B**	
From Output Diode A Terminals	To Power Output PCB Terminal	From Output Diode B Terminals	To Power Output PCB Terminal
E34, E39	E37	E34, E39	E36
E48, E50	E47	E48, E50	E45
E56, E60	E58	E56, E60	E57
E53, E54	E52	E53, E54	E49

E. Output Power PC Board Replacement

Follow the antistatic procedures in subsection 5.02.

1. Remove cover per subsection 5.04-A.
2. Locate the Power Output PC Board, mounted to the Heatsink Shroud.
3. Carefully remove all wire connections to the Output Diodes.
4. Straighten the Output Diode wires to be perpendicular to the Output Power PC Board.
5. Label, then disconnect all other wire connections to the Output Power PC Board. Refer to Appendix 10 for output power PC Board wiring details.
6. Remove the bolts at the top left and bottom right corners of the Output Power PC Board.



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7. Lift the Output Power PC Board off its supports, and set aside.
8. Install the replacement Output Power PC Board by reversing the above steps.
9. Note that the output power PC Board includes a jumper wire between studs E58 and E57. Refer to Appendix 10 for output power PC Board wiring details.

F. Heatsink Shroud Assembly Removal

The Heatsink Shroud Assembly must be disengaged for access to either the Main Transformer or the Output Inductor. Follow these steps for access to either component.

1. Remove the Power Supply cover per subsection 5.04-A.
2. Release the tab on the vertical face of the Heatsink Shroud securing the Solenoid/Pressure Switch Assembly in position.
3. Remove the gas hose from the Regulator Fitting on the back panel of the Power Supply by pressing on the locking ring on the elbow fitting, while pulling on the hose.
4. Remove the Power Supply Back Panel per subsection 5.07-D.

   Remove the grommets from the two holes on the right (rear) edge of the Heatsink Shroud.
5. Remove the Fan Assembly per subsection 5.08C.
6. Label and disconnect the wires connected to the Pilot PC Board.
7. Remove the hardware securing the Pilot PC Board in place. Pull the PC Board off the center chassis.
8. Label and disconnect wires No. 45, 47, 49, and 52 from the Power Output PC Board.
9. Disconnect the wires from the Output Inductor to terminal E43 on the Power Output PC Board.

   Disconnect the torch receptacle ground wire connected to the center chassis.
10. Remove nuts on two studs at the top corners of the Heatsink Shroud, and nuts on two studs on the bottom flange of the Heatsink Shroud.
12. Remove the Heatsink Shroud as follows:
    a. Use the open left end of the Heatsink Shroud and the Pressure Switch/Solenoid opening as handles.
    b. Pull the Heatsink Shroud away from the center chassis, and then up. It may be necessary to pry the top and bottom flanges of the Heatsink Shroud slightly to release them from their mounting studs. Movement will be limited by the wiring harness.

G. Main Transformer Removal and Replacement

1. Disengage the Heatsink Shroud per Paragraph H.
2. Disconnect wires #27 and 32, connected to terminals E27 and E32 on the Main Power PC Board. Pull these wires through the hole in the center chassis.
3. Remove the transformer.
   a. Lift the Main Transformer slightly. Swing its left edge away from the center chassis. Pull its right edge away from the center chassis.
   b. Lift it out of the Power Supply through the opening at the rear of the Power Supply.
4. Position the replacement Main Transformer behind the Heatsink Shroud Assembly. Position its wires at the right edge (as you face it) of the transformer.
5. Install the replacement transformer as follows:
   a. Pass the tabs on the right edge of the base of the transformer into slots in the center chassis of the Power Supply.
   b. Swing the transformer against the chassis, and pass the tabs on the left edge of the base into slots in the chassis. Press the transformer downward to lock it into position.
   c. Check for proper installation; the transformer should remain securely in place.
6. Pass wires #27 and 32 through the hole in the center of the main chassis. Connect wire #27 to terminal E27 and wire #32 to terminal E32 on the Main Power PC Board.
7. Replace the Heatsink Shroud Assembly per subsection I.

H. Output Inductor Assembly Removal and Replacement

1. Disengage the Heatsink Shroud per paragraph H.
2. Disconnect the wires to the thermal switch on the Output Inductor.
3. Remove hex nuts at the left forward and right rear corners of the Inductor base.
4. Remove the Inductor as follows:
   a. Note the position of the wires leading from the Inductor.
   b. Lift out the Inductor through the opening at the rear of the Power Supply. It may be necessary to lift the Main Transformer slightly to create room for the Inductor to pass through the rear opening.
5. Install the replacement Inductor.
   a. Put the replacement Inductor in place, with the wires oriented the same way as the original Inductor.
   b. Secure the Inductor in place with hex nuts at opposite corners of the Inductor base.
6. Reconnect the wires to the thermal switch on the Output Inductor.
7. Replace the Heatsink Shroud per paragraph I.

I. Heatsink Shroud Assembly Replacement

1. Pass transformer wires #45 and 49 through the upper hole in the right (rear) edge of the Heatsink Shroud. Pass transformer wires #47 and 52 through the lower hole.
2. Route wires as follows:
   a. Pass the red wires from the output inductor through the upper hole in the right (rear) edge of the Heatsink Shroud.
   b. Pass the black wires from the output inductor through the lower hole in the right (rear) edge of the Heatsink Shroud. Refer to Appendix 11, Power Output Board Layout.
   c. Pass the wires from the temperature switch on the Output Inductor through the upper hole in the Shroud.
3. Re-install the Heatsink Shroud as follows:
   a. Lift the Heatsink Shroud (Assembly) into position. Studs on the Power Supply base pass through holes in the bottom flange of the Shroud.
   b. Swing the top edge of the Shroud Assembly into place. Studs on the Center Chassis of the Power Supply pass through holes in the top flanges of the Shroud.
   c. Ensure that the rubber feet on the Main Transformer engage holes in the Shroud.

d. Put hex nuts on the studs. Tighten the nuts on the right (rear) top and bottom studs. Leave the nuts on the left (forward) studs loose temporarily.

4. Put the Fan Assembly in place per subsection 5.08-C. Reconnect the work cable to terminal E61 on the Power Output PC Board.

5. Tighten the nuts securing the left edge of the Heatsink Shroud Assembly. The stud and nut on the bottom left edge fasten a wire stay to the Power Supply.

6. Replace the grommets around the wire harnesses passing through the right (rearward) edge of the Heatsink Shroud.

7. Reinstall the Pilot Board. Reconnect the wires to the Pilot Board.

   Reconnect the torch receptacle ground wire to the center chassis.

9. Replace the Pressure Switch/Solenoid Assembly. This assembly fits into a slot in the top horizontal surface of the Heatsink Shroud. A notched pin holds the assembly in place.

10. Connect the gas hose between the Regulator/Filter Assembly and the Gas Pressure Switch/Solenoid Assembly.

11. Connect wiring to the Output Power PC Board. Refer to the Appendix pages for wiring layout.

12. Replace the Power Supply rear panel per subsection 5.07-D.

This concludes the replacement procedures.

SECTION 6: PARTS LISTS

6.01 Introduction

A. Parts List Breakdown

The parts lists provide a breakdown of all replaceable components. The parts lists are arranged as follows:

Section 6.03 Major External Replacement Parts

Section 6.04 Front Panel Replacement Parts

Section 6.05 Left Side Internal Component Replacement Parts

Section 6.06 Rear Panel Replacement Parts

Section 6.07 Right Side Internal Component Replacement Parts

Section 6.08 Options and Accessories

NOTE

Parts listed without item numbers are not shown, but may be ordered by the catalog number shown.

B. Returns

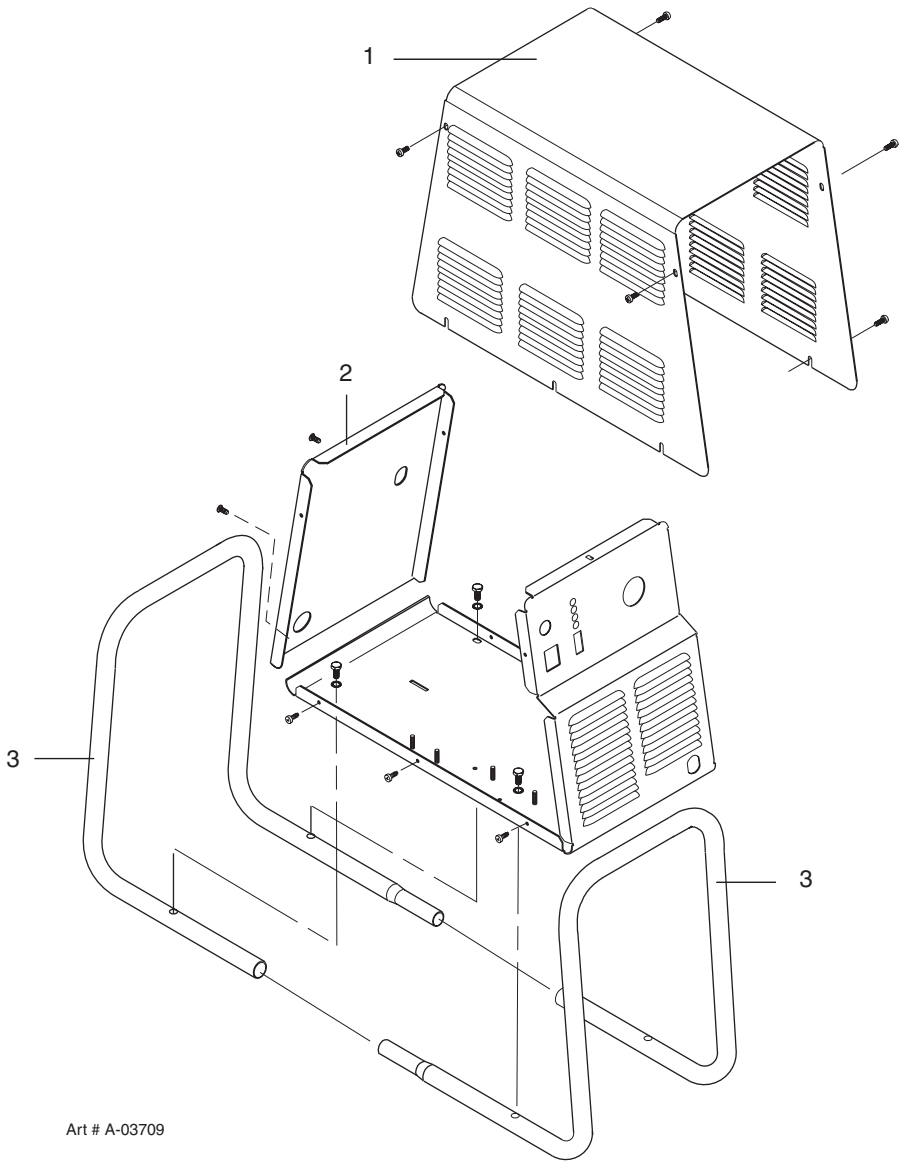
If a product must be returned for service, contact your distributor. Materials returned without proper authorization will not be accepted.

6.02 Ordering Information

Order replacement parts by catalog number and complete description of the part or assembly, as listed in the parts list for each type item. Also include the model and serial number of the torch. Address all inquiries to your authorized.

6.03 Major External Replacement Parts

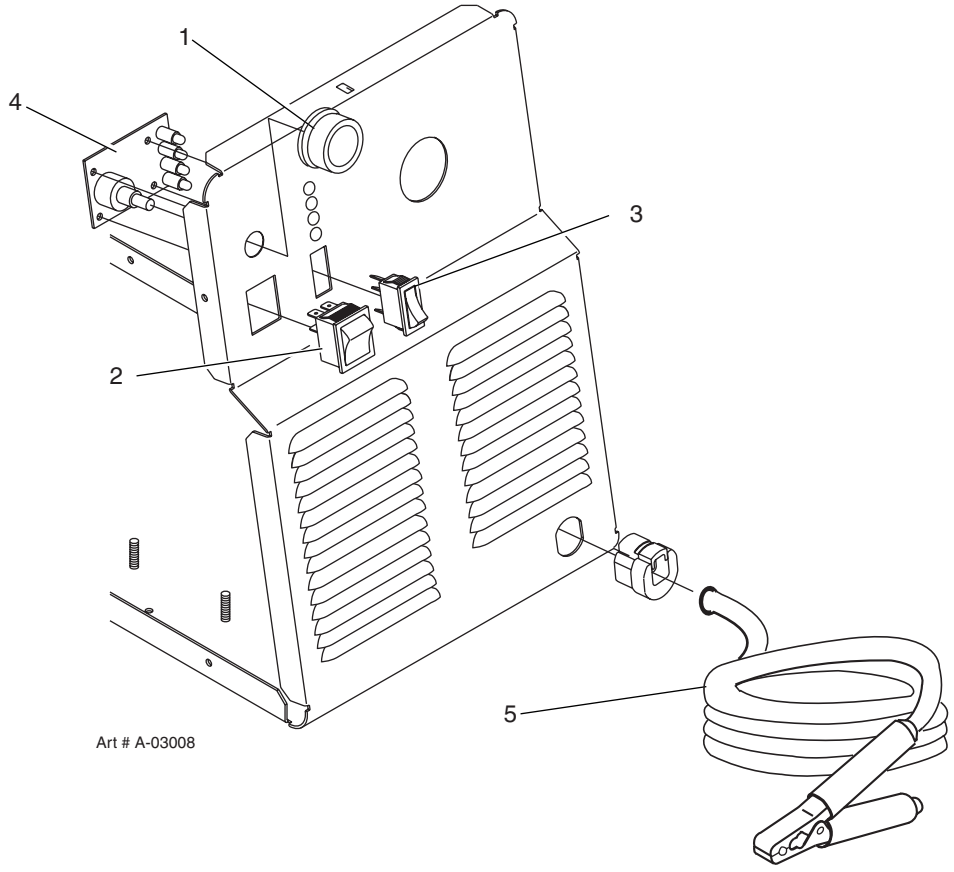
Item #	Qty	Description	Catalog #
1	1	Cover with labels	9-7997
2		Rear Panel (provide data tag information when ordering)	
	1	For 208/230-Volt Power Supplies	9-8323
	1	For 400-Volt, 415-Volt, 460-Volt, and 600-Volt Power Supplies	9-8322
3`	1	Tube, roll handle	9-7998



NOTE: Illustration may vary slightly from unit.

6.04 Front Panel Replacement Parts

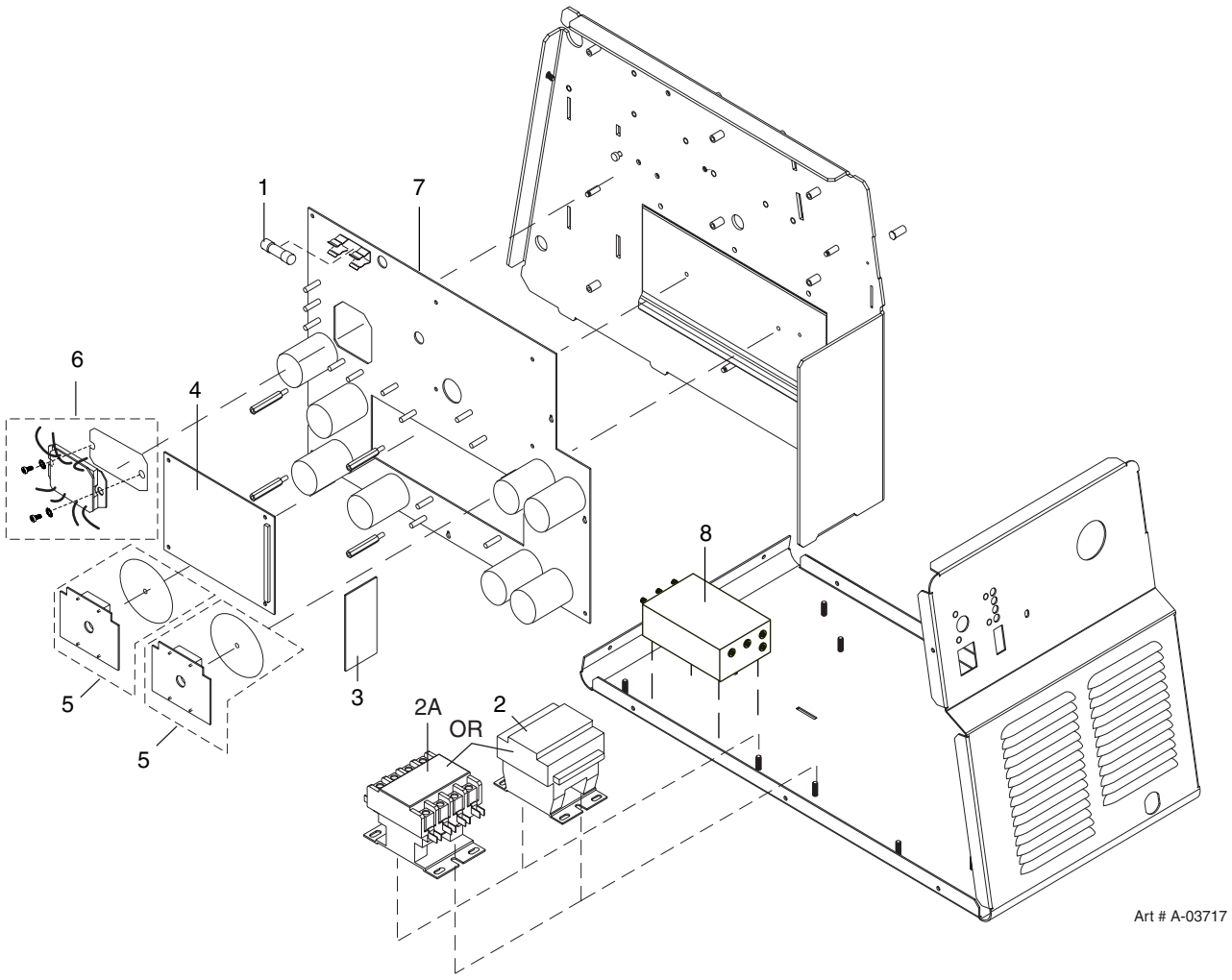
Item#	Qty	Description	Ref. #	Catalog #
1	1	Knob, Fluted, Skirted, 0.250 I.D.		9-8527
2	1	On/Off Rocker Switch, DPST		8-3258
3	1	Run/Rapid Auto Restart / Set Switch		8-3259
4	1	Assembly, Pot/LED PCB		9-8004
5	1	Cable, Work, #6 AWG, with Clamp, 20 Ft. (6.1 m)		9-8528



NOTE: Illustration may vary slightly from unit.

6.05 Left Side Internal Component Replacement Parts

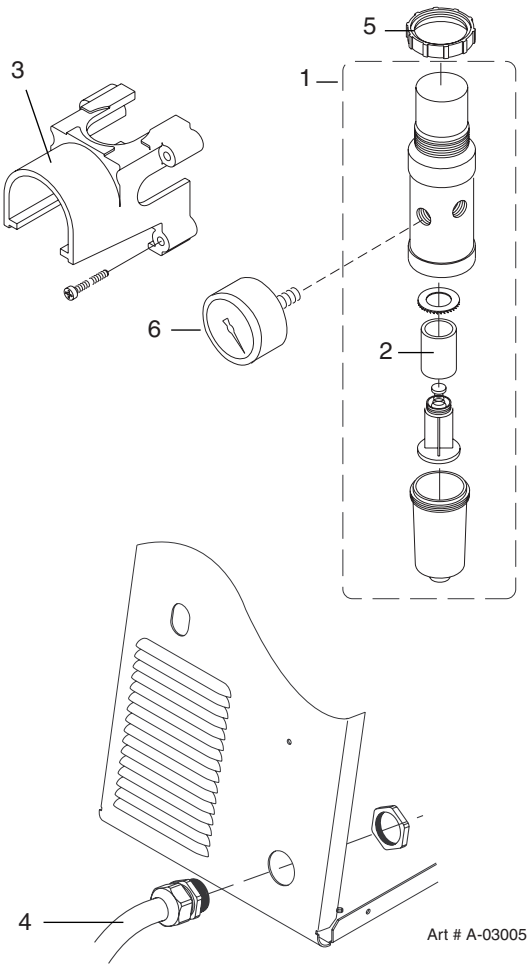
Item #	Qty	Description	Ref #	Catalog #
1	1	Fuse	F1	
		for 208/230-Volt Power Supplies		9-8588
		for 400-Volt and 415-Volt Power Supplies		9-8602
		for 460-Volt Power Supplies		9-8583
		for 600-Volt Power Supplies		9-8638
		Main Input Contactor	W1	
2A		for 208/230-Volt Power Supplies		9-8587
2		for 400-Volt, 415-Volt 460-Volt and 600-Volt Power Supplies		9-8554
3	1	Connector PCB		9-8576
4	1	PCB Assembly, Logic Board, for Non-Mechanized units		9-7992
4	1	PCB Assembly, Logic Board, for Mechanized units		9-9440
5	1	PCB Assembly Kit, IGBT Circuit		
		for 208/230-Volt, 400-Volt, 415-Volt and 460-Volt Power Supplies		9-8578
		IGBT PCB		
		Round Thermal Pad		
		for 600-Volt Power Supplies		9-8646
		IGBT PCB		
		Round Thermal Pad		
6	1	PCB Assembly Kit, Input Diode		9-7088
		Input Diode PCB		
		Rectangular Thermal Pad		
7	1	PCB Assembly, Main Power		
		for 208/230-Volt Power Supplies		9-7986
		for 400-Volt Power Supplies		9-7990
		for 415-VoltPower Supplies		9-8669
		for 460-Volt Power Supplies		9-7989
		for 600-Volt Power Supplies		9-7991
8	1	EMI Filter Kit (CE Power Supplies only)		9-7667



NOTE: Illustration may vary slightly from unit.

6.06 Rear Panel Replacement Parts

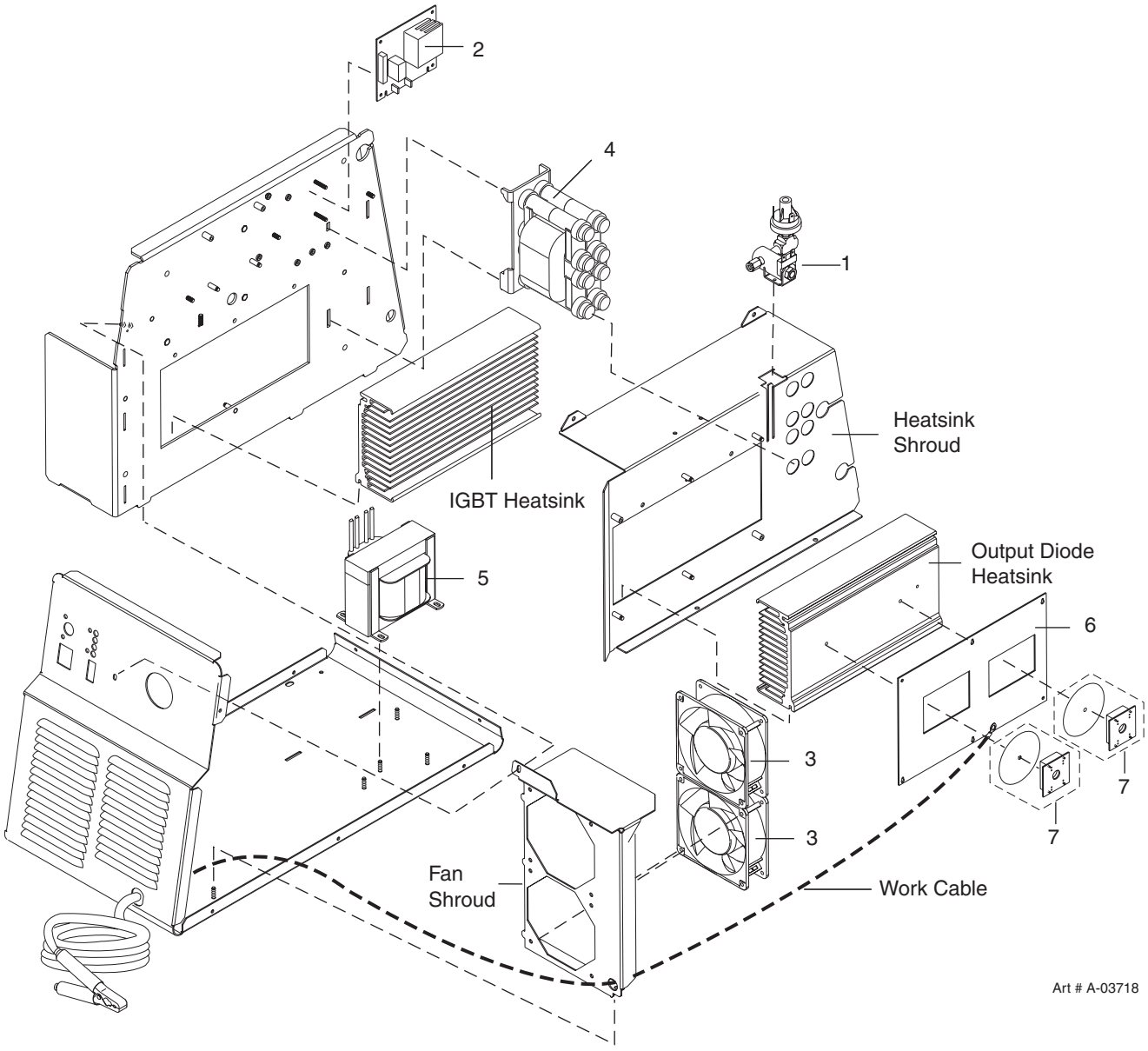
Item #	Qty	Description	Ref.	Catalog #
1	1	Assembly, Filter/Regulator		9-7514
2	1	Regulator/Filter Replacement Element		9-4414
3	1	Regulator Mounting Bracket		9-7589
4		Input Power Cable		
	1	for 208/230-Volt Units		9-8596
	1	for 400-Volt Three-Phase units		9-8562
	1	for 400-Volt and 415-Volt CE units		9-8553
	1	for 460-Volt Three-Phase units		9-8593
	1	for 600-Volt Three-Phase units		9-8593
5	1	Mounting Nut		9-5804
6	1	Pressure Gauge		9-1045



NOTE: Illustration may vary slightly from unit.

6.07 Right Side Internal Component Replacement Parts

Item #	Qty	Description	Ref #.	Catalog #
1	1	Assembly, Pressure Switch/Solenoid	Sol1, Ps1	9-8329
2	1	Assembly, Pilot Board		9-8337
3	1	Fan, 220V, 115 CFM		9-7687
4	1	Assembly, Main Transformer	T5	
		for 208/230-Volt units		9-8589
		for 400 Volt and 415-Volt units		9-8603
		for 460-Volt units		9-8584
		for 600-Volt units		9-8635
5	1	Assembly, Output Inductor	L1	9-8591
6	1	Assembly, Output Power PCB		9-7988
7	1	Assembly, Output Diode PCB		9-8580
	1	Round Thermal Pad		



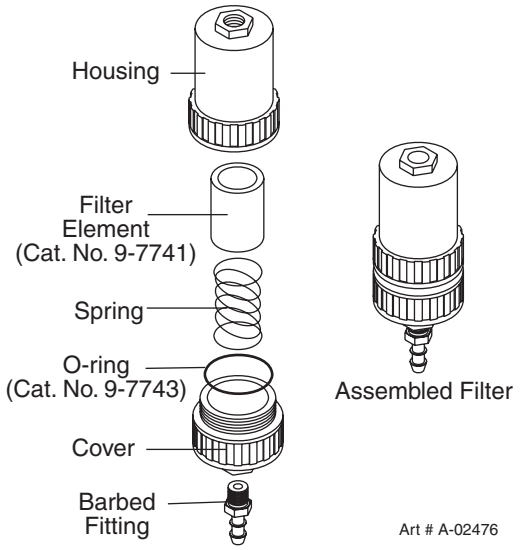
NOTE: Illustration may vary slightly from unit.

6.08 Options and Accessories

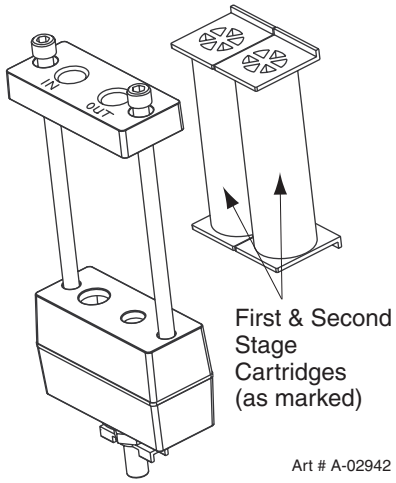
Qty	Description	Catalog #
1	Single-Stage Filter Kit (Includes Filter And Hose)	7-7507
1	Replacement Filter Body	9-7740
1	Replacement Filter Element	9-7741
1	Replacement Filter Hose (Not Shown)	9-7742
1	Two Stage Air Line Filter Kit (Includes Hose & Mounting Screws)	7-7500
1	Bracket, Filter Mounting	9-7535
1	Dual Stage Air Filter Assembly	9-7527
1	Replacement First Stage Cartridge	9-1021
1	Replacement Second Stage Cartridge	9-1022

Not Shown:

1	Extended Work Cable - 50 ft (15.2 M)	9-8529
1	Wheel Kit	9-8331
1	Nylon Canvas Power Supply Dust Cover	9-7072



Single-Stage Filter Kit



Two-Stage Filter Kit

PATENT INFORMATION

The following parts are licensed under U.S. Patent No(s). 5120930 and 5132512

Catalog Number	Description
9-8235	Shield Cap, Drag 50-60A
9-8236	Sheild Cap, Drag 70-100A
9-8237	Shield Cup, Body
9-8238	Shield Cap, Machine 50-60A
9-8239	Shield Cap, Machine 70-100A
9-8244	Shield Cap, Drag 40A
9-8245	Shield Cap, Machine 40A

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APPENDIX 1: INPUT WIRING REQUIREMENTS

CutMaster 81 Input Wiring Requirements											
Input		**Power Input**		**Current Input**		**Suggested Sizes (See Notes)**					
Voltage	**Freq.**	**1-Ph**	**3-Ph**	**1-Ph**	**3-Ph**	**Fuse (Amps)**		**Wire (AWG)**		**Wire (Canada)**	
(Volts)	**(Hz)**	**(kVA)**	**(kVA)**	**(Amps)**	**(Amps)**	**1-Ph**	**3-Ph**	**1-Ph**	**3-Ph**	**1-Ph**	**3-Ph**
208	50/60	11.8		57		60		6		6	
230	50/60	11.8		52		60		6		6	
400	50/60		11.1		16		20		10		10
460	60	11.7		27		30		10		10	
460	60		10.8		16		20		12		12
600	60		10.5		10		15		12		12
Line Voltages with Suggested Circuit Protection and Wire Sizes Based on National Electric Code and Canadian Electrical Code											

CE CutMaster 81 Input Wiring Specifications					
Input		**Power Input**	**Current Input**	**Suggested Sizes (See Notes)**	
Voltage	**Frequency**	**3-Ph**	**3-Ph**	**Fuse (Amps)**	**Wire (mm^2)**
(Volts)	**(Hz)**	**(kVA)**	**(Amps)**	**3-Ph**	**3-Ph**
400/415	50	11.1	16	20	4
Line Voltages with Suggested Circuit Protection and Wire Sizes Based on National Electric Code and Canadian Electric Code					

NOTES

The table above is based on the following output current and voltage: 125VDC @ 40A

Refer to Local and National Codes or local authority having jurisdiction for proper wiring requirements.

Cable size is de-rated based on the Duty Cycle of the equipment.

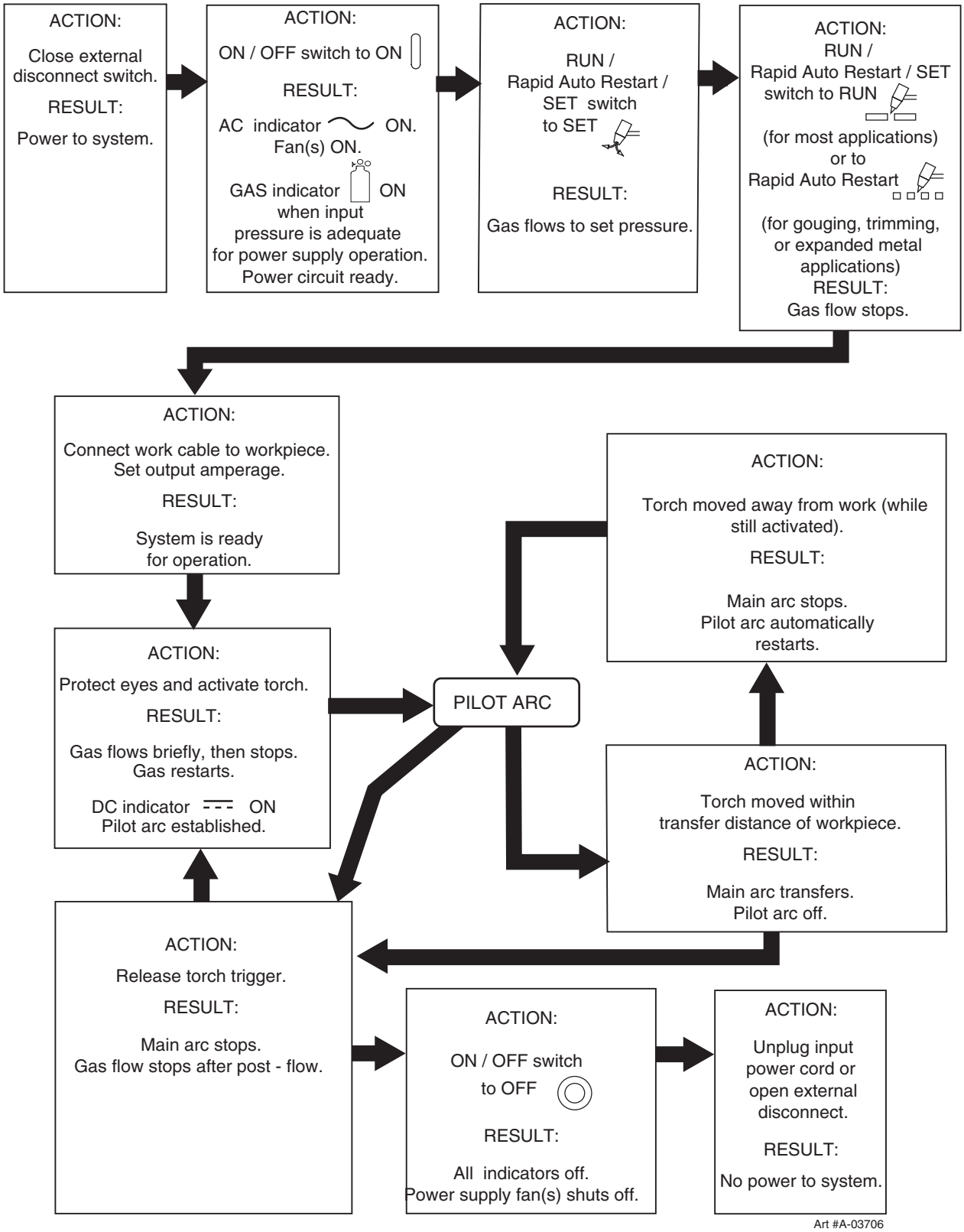
The suggested sizes are based on flexible power cable with power plug installations. For hard-wired installations refer to local or national codes.

Cable conductor temperature used is 167° F (75° C).

An energy limiting fuse UL Class RK-1 (examples: BUSS LPS/LPN-RK or Gould-Shawmut AZK-A6K) should be used to minimize damage to Plasma Cutting, Welding or power distribution equipment.

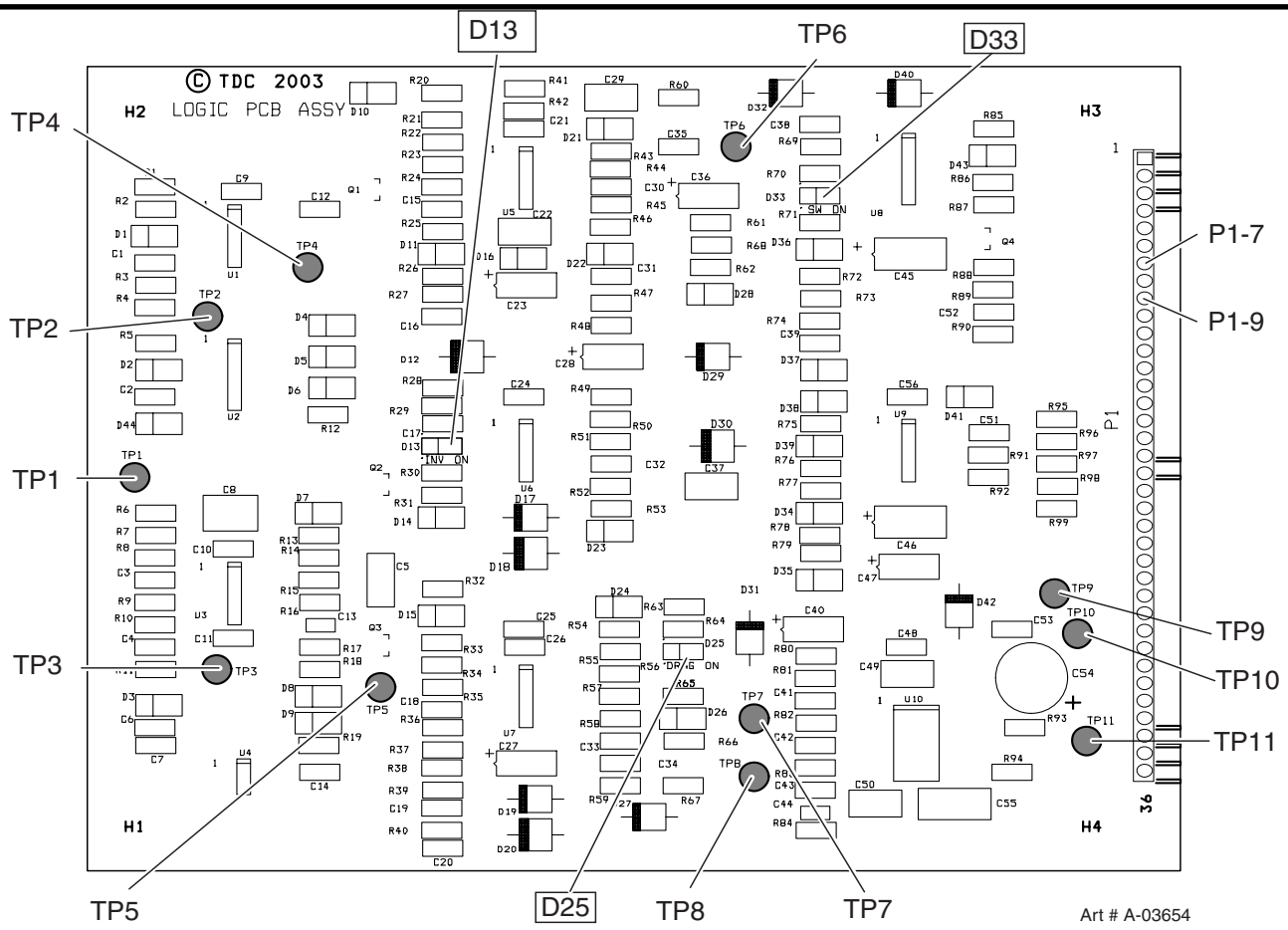
***NEVER** use replaceable element fuses like UL Class H, or "one-time" fuses like UL Class K5.*

APPENDIX 2: SEQUENCE OF OPERATION (BLOCK DIAGRAM)



Art #A-03706

APPENDIX 3: LOGIC PC BOARD LAYOUT



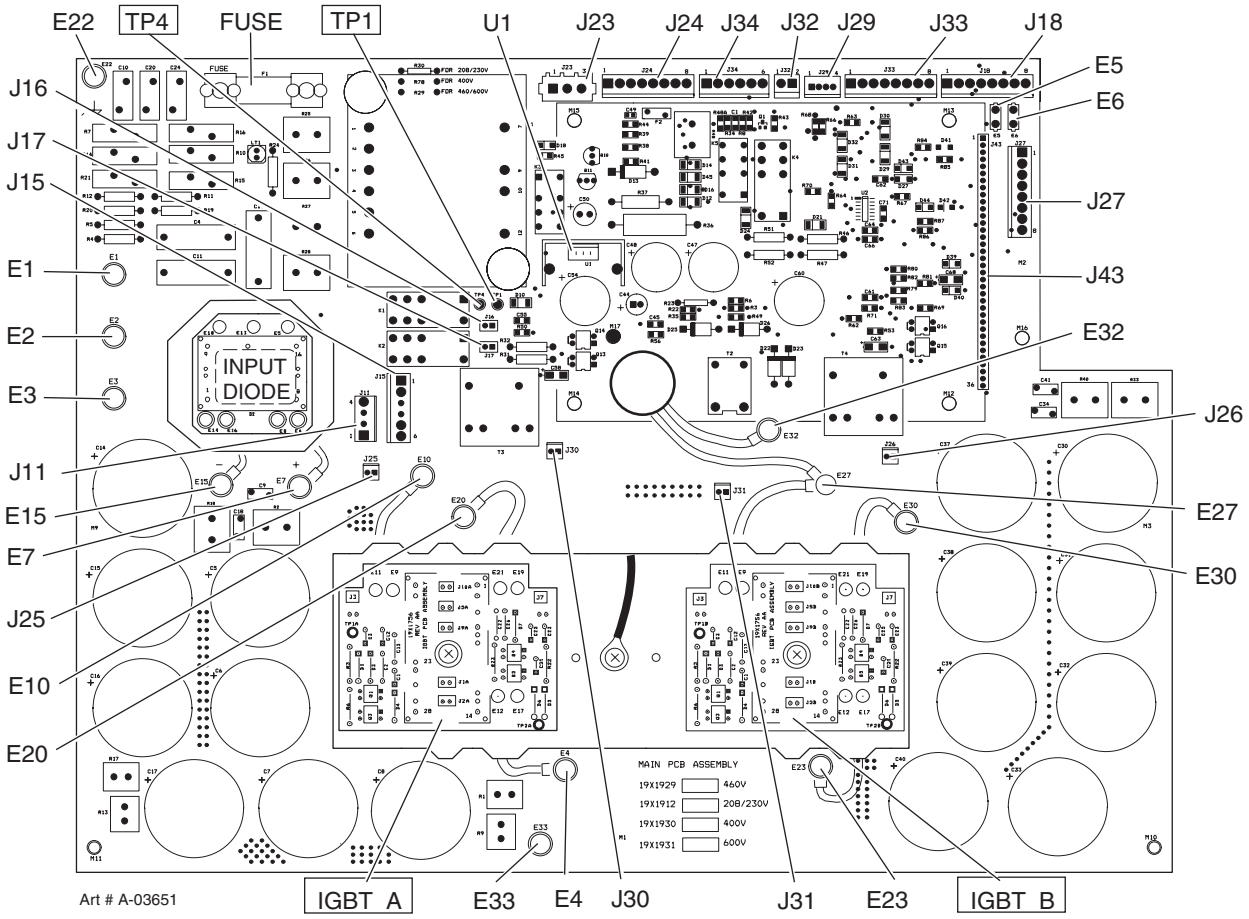
Logic Board Signals

P1-1 +12vdcfrom Main Power PCB
P1-2 +12vdcfrom Main PCB
P1-3 DC Com
P1-4 DC Com
P1-5 MC1 ON signal
P1-6 Tip Sense
P1-7 RUN/SET Signal Logic Low for SET
P1-8 Logic Low = PS1 Pressure Switch closed = Pressure OK
P1-9 Logic Low = TS1 Closed = OVERTEMP
P1-10 Logic Low = CSR
P1-11 Logic Low = Gas ON
P1-12 Logic Low = DC OK
P1-13 Logic Low = OVTEMP
P1-14 Logic Low = AC OK
P1-15 Logic Low = Torch Switch
P1-16 Logic Low = Torch Switch Return
P1-17 Logic Low = +12vdc
P1-18 Logic Low = Pot High
P1-19 Logic Low = Pot High
P1-20 Pot Low
P1-21 Gate Drive B Return
P1-22 Gate Drive B
P1-23 Gate Drive A Return
P1-24 Gate Drive A
P1-25 - Out Sense
P1-26 Current Sense
P1-27 Current Sense
P1-28 Current Sense Return
P1-29 Current Sense Return
P1-30 DC Com
P1-31 DC Com
P1-32 Not Used
P1-33 I Sense
P1-34 Not Used
P1-35 Not Used
P1-36 TipVolts

INDICATORS:
D13 INV ON
D25 DRAG ON
D33 SWITCH ON

TEST POINTS:
TP-1 Common
TP-2 Current Demand Signal
TP-3 Converter Enable
TP-4 CSR (Logic Low)
TP-5 Not used
TP-6 Fault (Logic Low)
TP-7 DC OK (Logic Low)
TP-8 Tip Sense
TP-9 Current Sense
TP-10 Gate Drive A
TP-11 Gate Drive B

APPENDIX 4: MAIN POWER PC BOARD LAYOUT



Main Power PC Board Signals

J11-1 L1 Input
J11-4 L3 Input

J15-1 Fan (M1)
J15-2 Fan (M1)
J15-3 Not used
J15-4 Not used
J15-5 Fan (M2)
J15-6 Fan (M2)

J16-1 Not used
J16-2 Not used

J17-1 Not used
J17-2 Not used

J18-1 Not used
J18-2 Not used
J18-3 28 VAC B
J18-4 28 VAC A
J18-5 On-Off Switch
J18-6 On-Off Switch
J18-7 Run-Set Switch
J18-8 Run-Set Switch

J23-1 Not used
J23-2 Not used
J23-3 Not used

J24-1 Gas Solenoid (SOL1)
J24-2 Gas Solenoid (SOL1)
J24-3 Pressure Switch (PS1)
J24-4 Pressure Switch (PS1)
J24-5 Main Contactor (W1)
J24-6 Main Contactor (W1)
J24-7 Not used
J24-8 Not used

J25-1 Gate Drive
J25-2 Gate Drive

J26-1 Gate Drive
J26-2 Gate Drive
J27-1 Pot High
J27-2 Pot Wiper
J27-3 Pot Low
J27-4 +12V
J27-5 AC
J27-6 Gas
J27-7 Overtemp
J27-8 DC

J29-1 IGBT Heatsink Temp
J29-2 IGBT Heatsink Temp
J29-3 Jumper
J29-4 Jumper

J30-1 Gate Drive
J30-2 Gate Drive

J31-1 Gate Drive
J31-2 Gate Drive

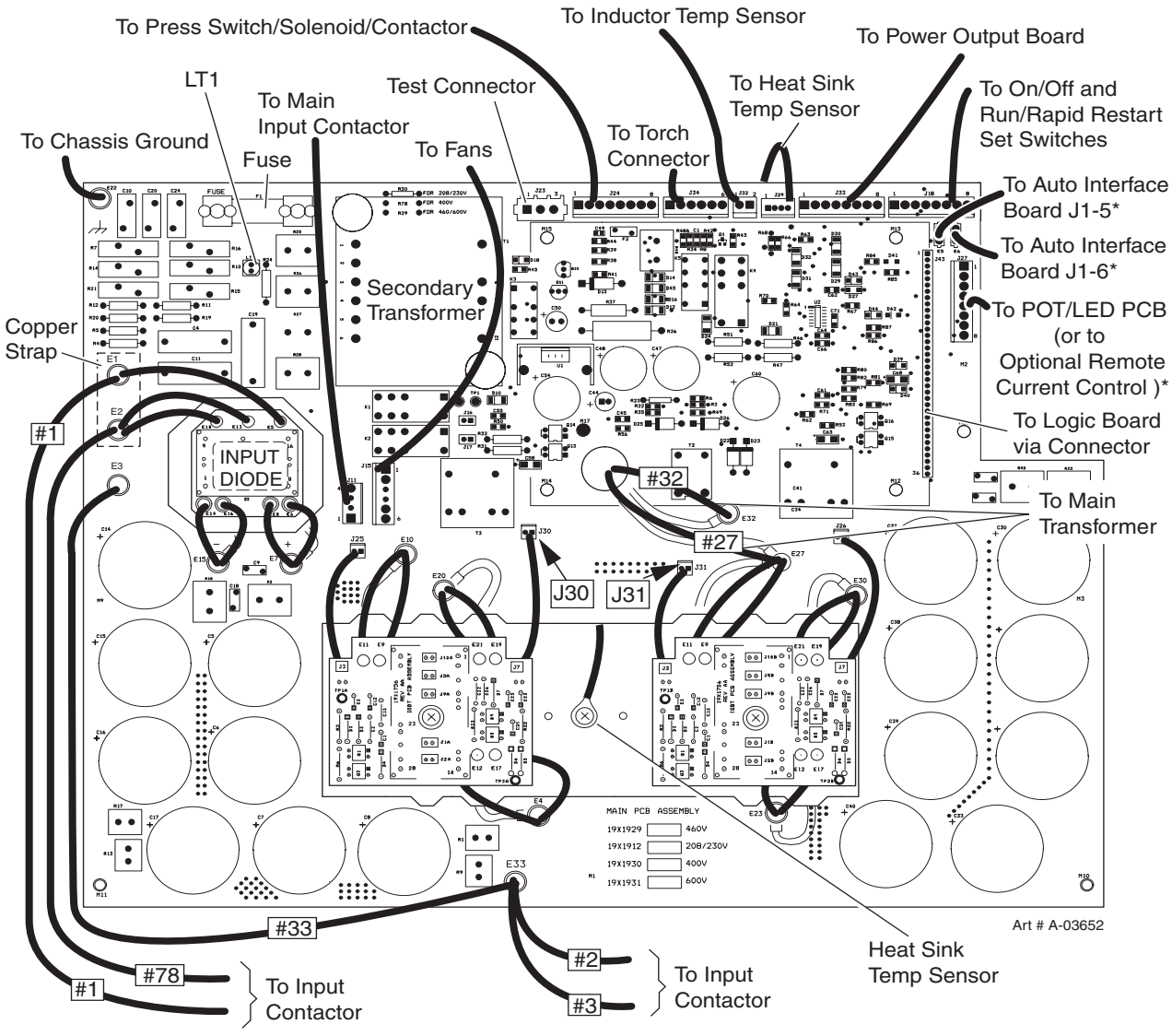
J32-1 Inductor Temp Switch
J32-2 Inductor Temp Switch

J33-1 - Out Sense
J33-2 DC Com
J33-3 Tip Sense
J33-4 + 12 vdc
J33-5 CSR
J33-6 I Sense
J33-7 Not used
J33-8 Tip volts
J34-1 PIP Return
J34-2 PIP
J34-3 Not used
J34-4 Not used
J34-5 Torch Switch Return
J34-6 Torch Switch

J43-1 + 12 vdc to Logic PCB
J43-2 + 12 vdc to Logic PCB
J43-3 DC Com
J43-4 DC Com
J43-5 MC1 On
J43-6 Tip Sense
J43-7 Run / Set
J43-8 Pressure Good
J43-9 Overtemp
J43-10 CSR
J43-11 Gas on
J43-12 DC OK
J43-13 OVTEMP
J43-14 AC OK
J43-15 Torch Switch
J43-16 Torch Switch Return
J43-17 + 12 vdc
J43-18 POT High
J43-19 POT Wiper
J43-20 POT Low
J43-21 Gate Drive B Return
J43-22 Gate Drive B
J43-23 Gate Drive A Return
J43-24 Gate Drive A
J43-25 - Out Sense
J43-26 Current Sense
J43-27 Current Sense
J43-28 Current Sense Return
J43-29 Current Sense Return
J43-30 DC Com
J43-31 DC Com
J43-32 Not Used
J43-33 I Sense
J43-34 Not Used
J43-35 Not Used
J43-36 Tip Volts

TP1 Ground
TP4 +12 vdc

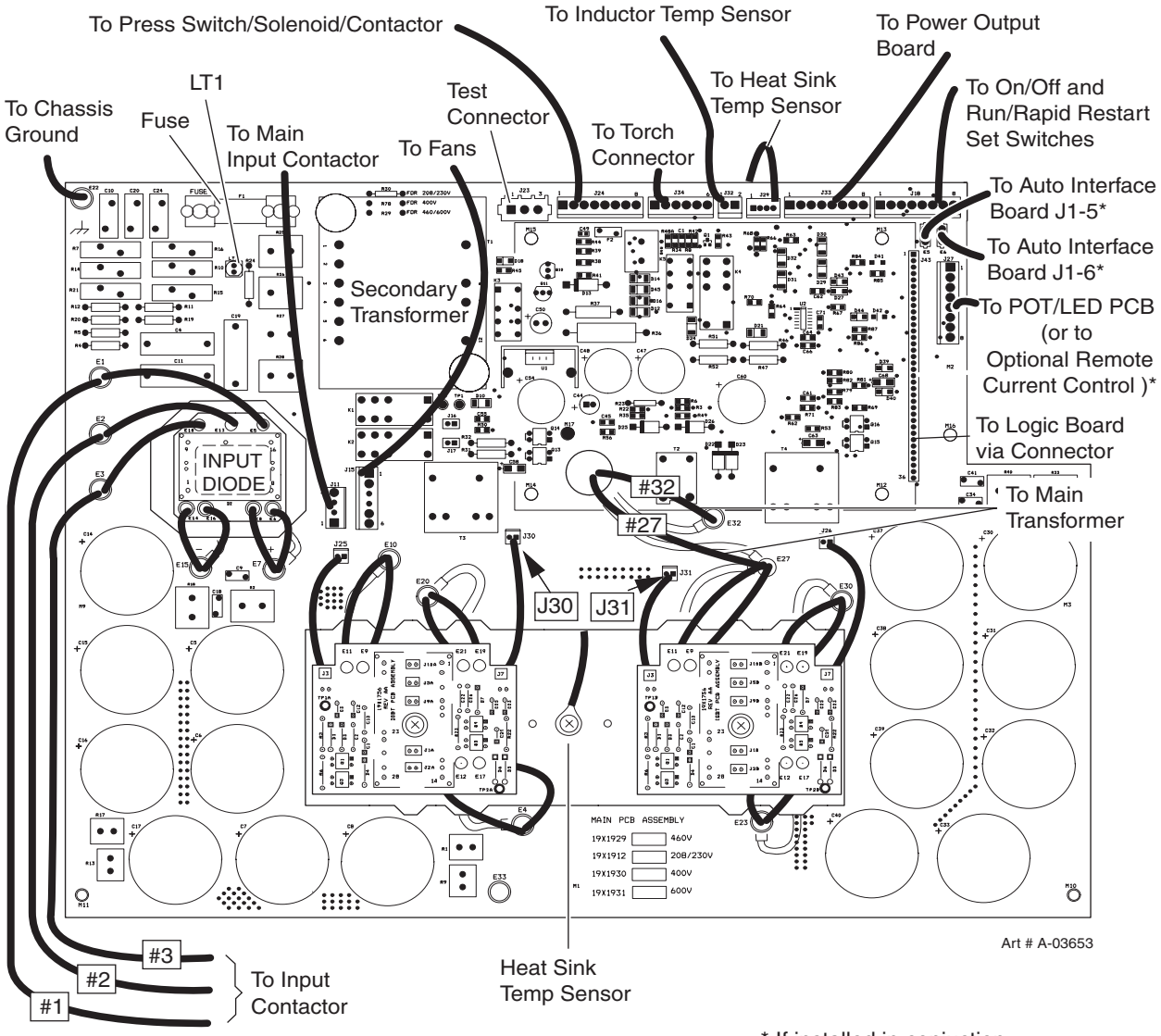
APPENDIX 5A: MAIN PC BOARD WIRING LAYOUT - 208/230-Volt Units



* Automation Interface Board is not installed in all units.

* If installed in conjuction with Automation Interface PC Board

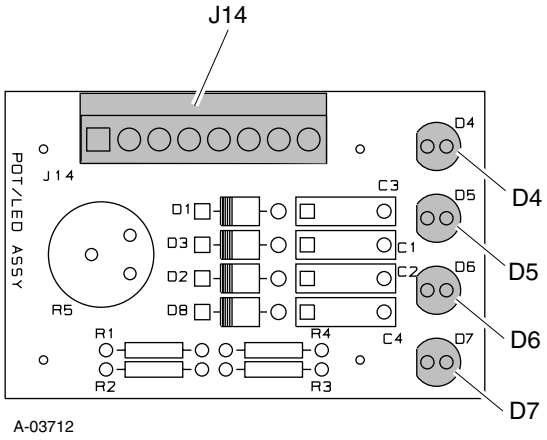
APPENDIX 5B: MAIN PC BOARD WIRING LAYOUT - 400-Volt, 415-Volt 460-Volt, and 600-Volt Units



* If installed in conjuction with Automation Interface PC Board

* Automation Interface Board is not installed in all units.

APPENDIX 6: LED/POT PC BOARD LAYOUT

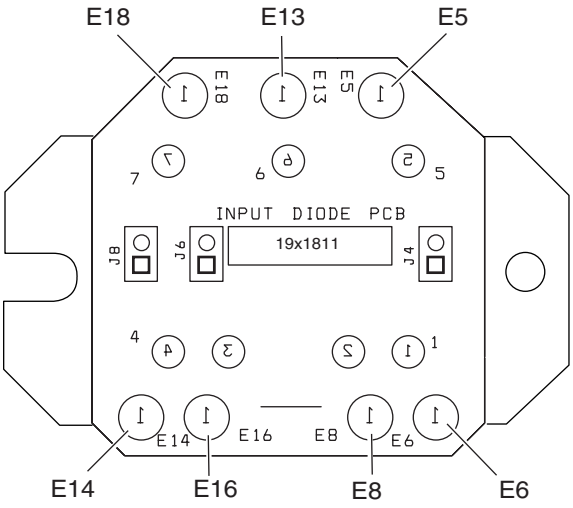


Pot/LED PC Board Signals

J14-1 from Main PC Board (J27-1) Pot High
J14-2 Main PC Board (J27-2) Pot Wiper
J14-3 from Main PC Board (J27-3) Pot Low
J14-4 12vdc (J27-4)
J14-5 Logic Low Signal for AC OK Indicator from Logic PC Board (J27-5)
J14-6 Logic Low Signal for GAS Indicator from Logic PC Board (J27-6)
J14-7 Logic Low Signal for TEMP Indicator from Logic PC Board (J27-7)
J14-8 Logic Low Signal for DC Indicator from Logic PC Board (J27-8)

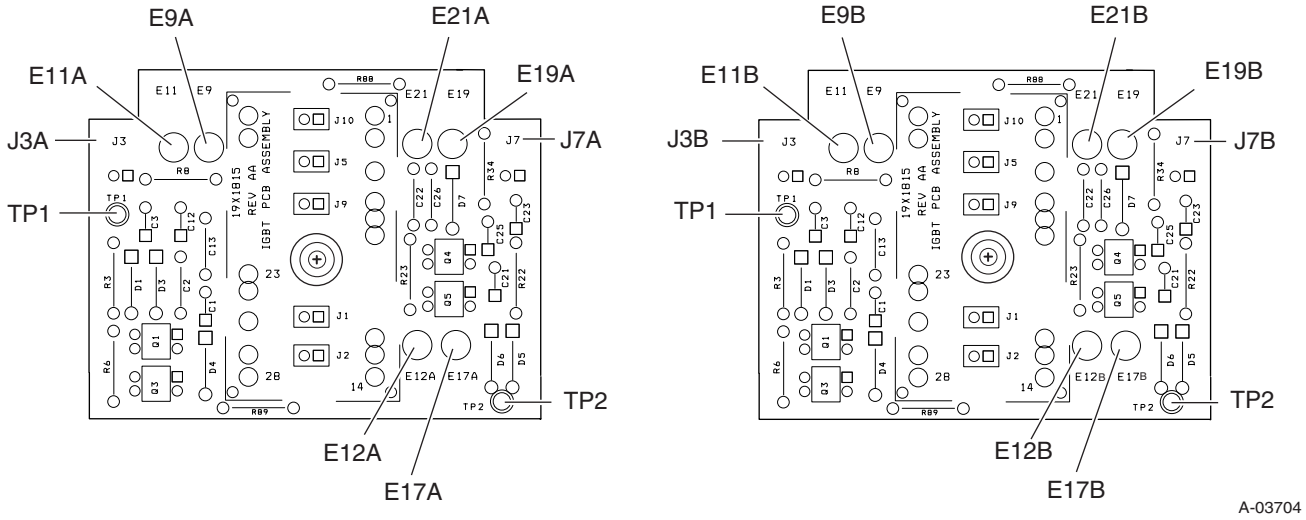
D4 Front Panel AC Indicator
D5 Front Panel TEMP Indicator
D6 Front Panel GAS Indicator
D7 Front Panel DC Indicator

APPENDIX 7: INPUT DIODE PC BOARD LAYOUT



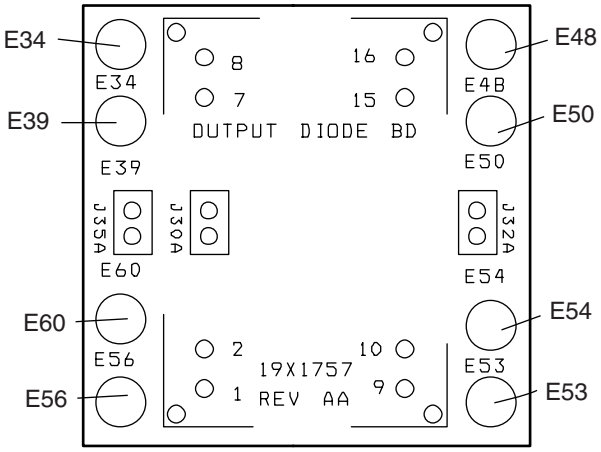
Art # A-03703

APPENDIX 8: IGBT CIRCUIT PC BOARD LAYOUT

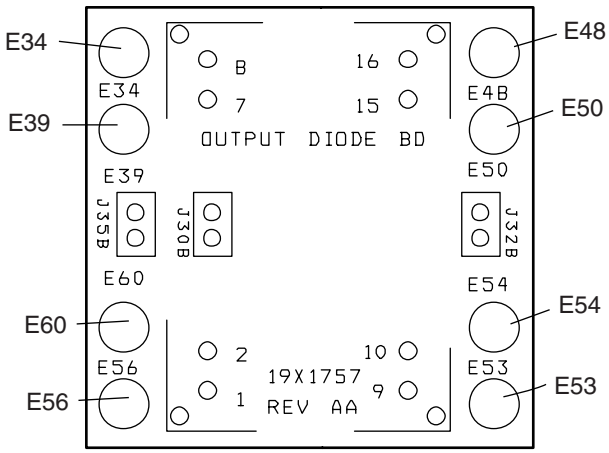


APPENDIX 9: OUTPUT DIODE PC BOARD LAYOUT

Output Diode A

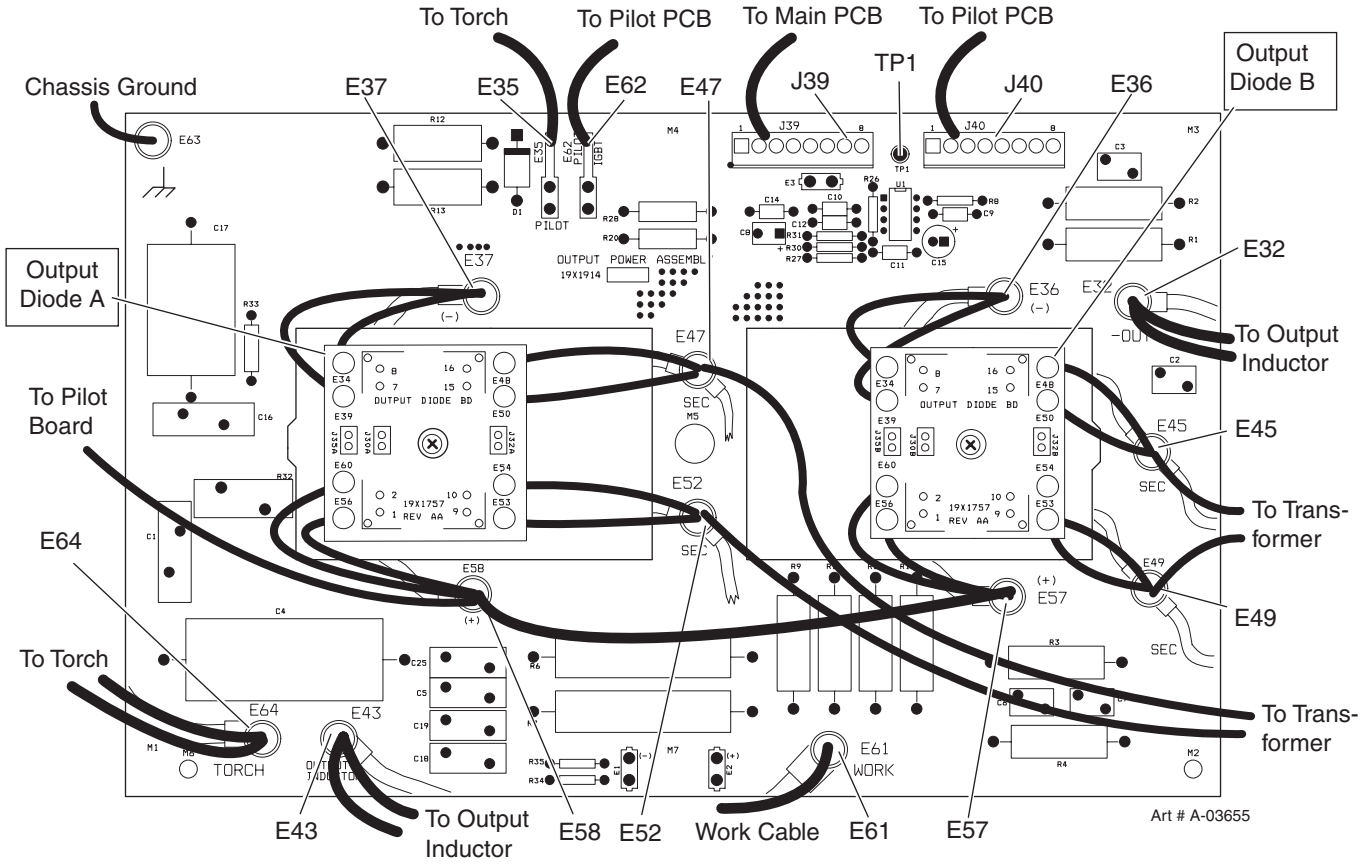


Output Diode B

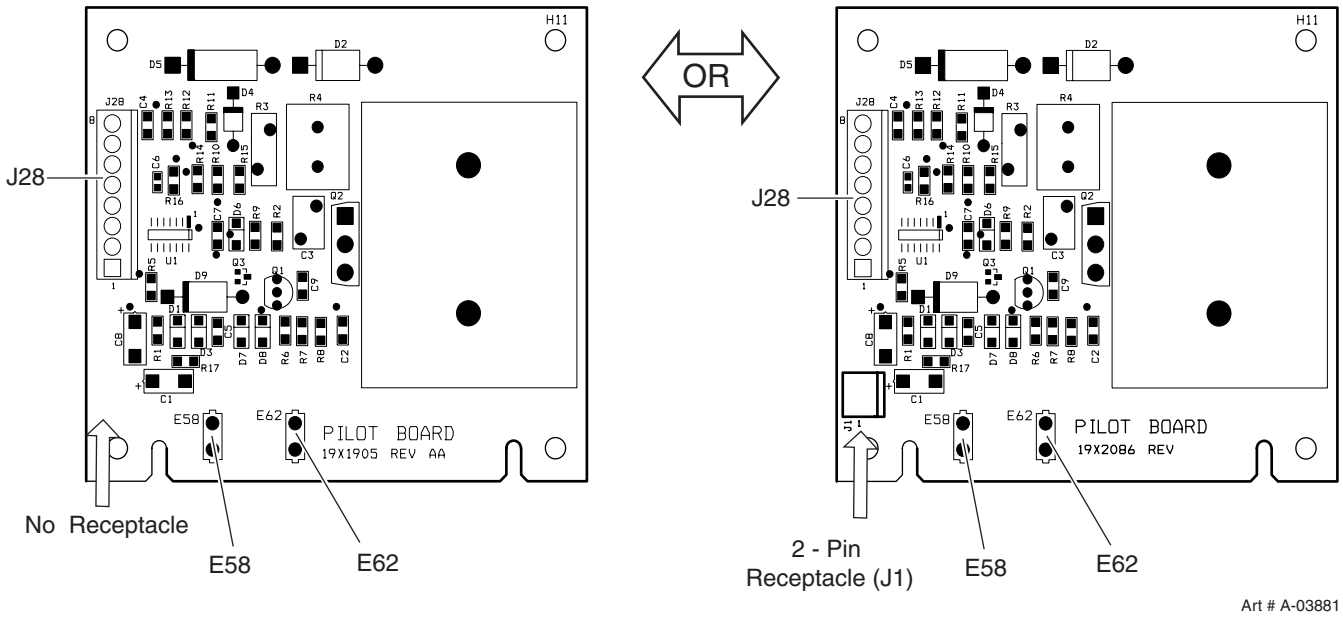


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APPENDIX 10: OUTPUT BOARD WIRING DIAGRAM



APPENDIX 11: PILOT PC BOARD LAYOUT



Art # A-03881

CD PC Board Signals

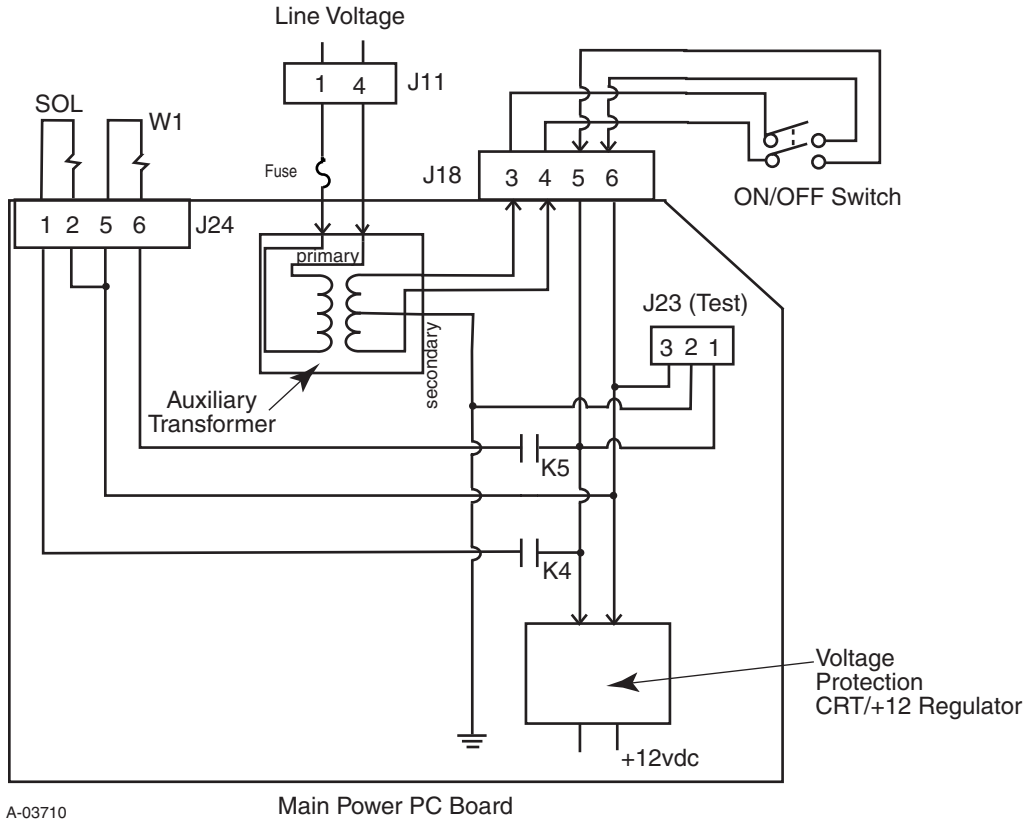
J28-1 +12 vdc
J28-2 DC Com
J28-3 Not Used
J28-4 Not Used
J28-5 Logic Low CSR
J28-6 Not Used
J28-7 Not Used
J28-8 Not Used

E58 To Power Output PC Board Terminal E58
E62 To Power Output PC Board Terminal E62

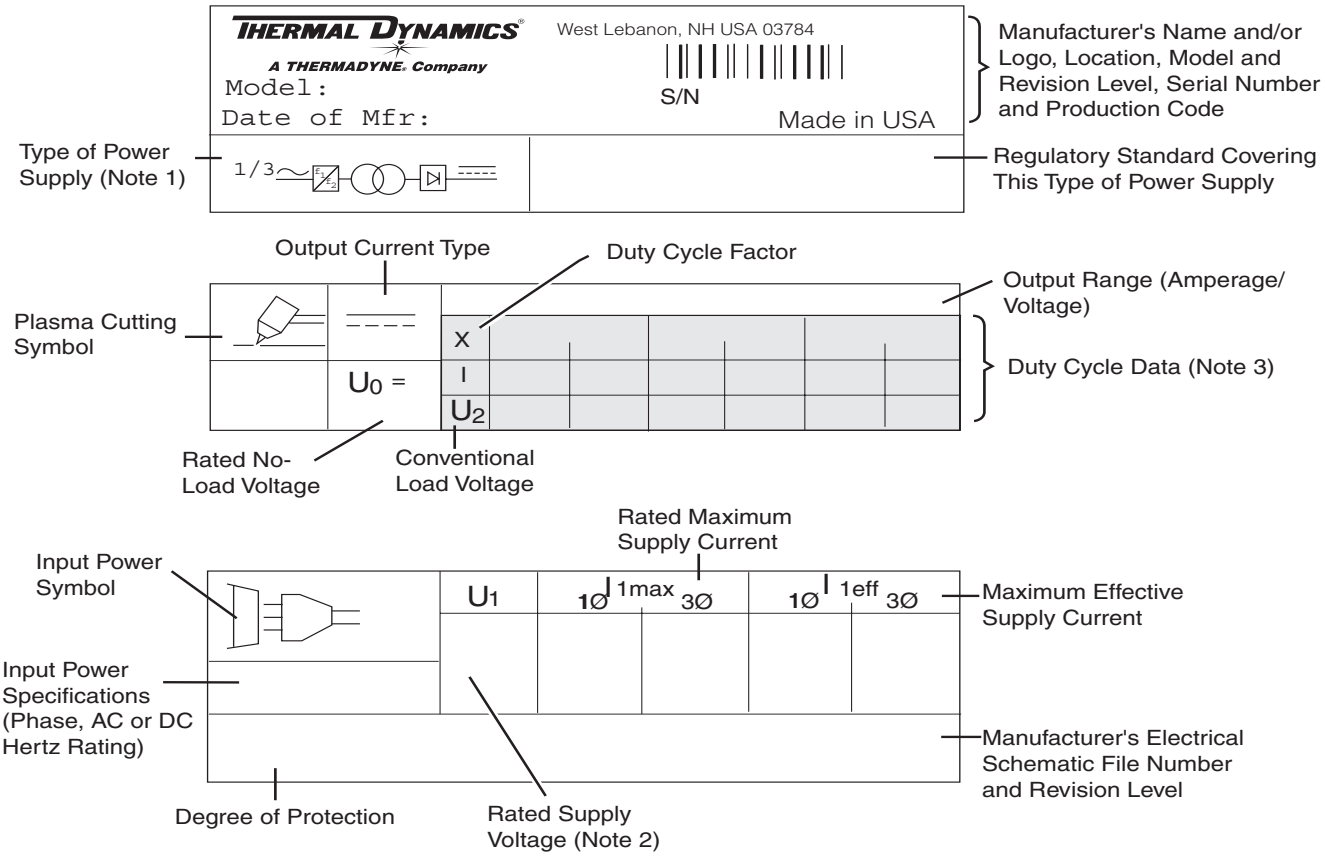
NOTES

1. *Pilot PC Board with receptacle J1 may replace PC Board without receptacle J1.*
2. *Receptacle J1 is used only in automated applications.*

APPENDIX 12: 28VAC CIRCUIT DIAGRAM



APPENDIX 13: DATA TAG INFORMATION



NOTES:

1. Symbol shown indicates single- or three-phase AC input, static frequency converter-transformer-rectifier, DC output.
2. Indicates input voltages for this power supply. Most power supplies carry a label at the input power cord showing input voltage requirements for the power supply as built.
3. Top row: Duty cycle values.
   IEC duty cycle value is calculated as specified by the International ElectroTechnical Commission.
   TDC duty cycle value is determined under the power supply manufacturer's test procedures.
   Second row: Rated cutting current values.
   Third row: Conventional load voltage values.
4. Sections of the Data Tag may be applied to separate areas of the power supply.

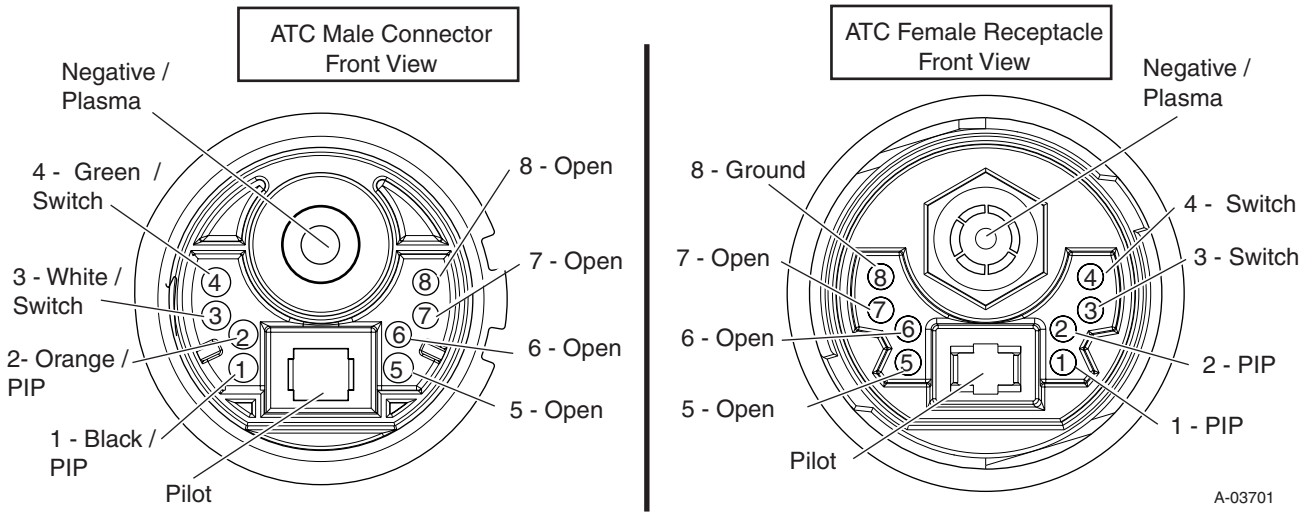
Standard Symbols

~	AC
⎓	DC
Ø	Phase

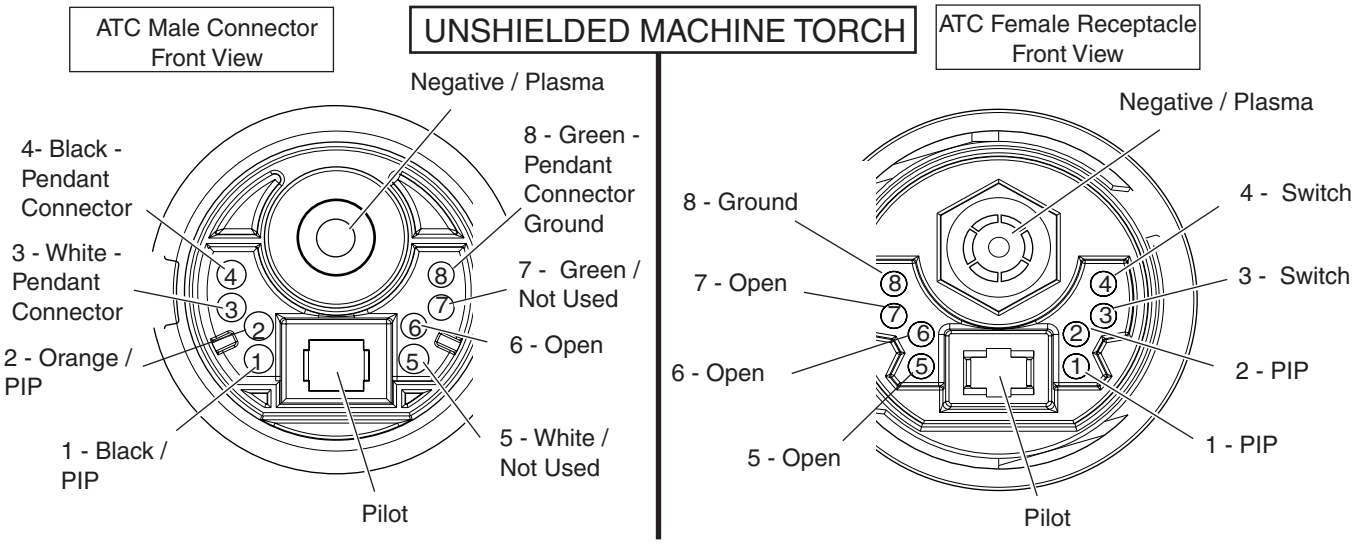
Art # A-03288

APPENDIX 14: TORCH PIN-OUT DIAGRAMS

A. Hand Torch Pin - Out Diagrams



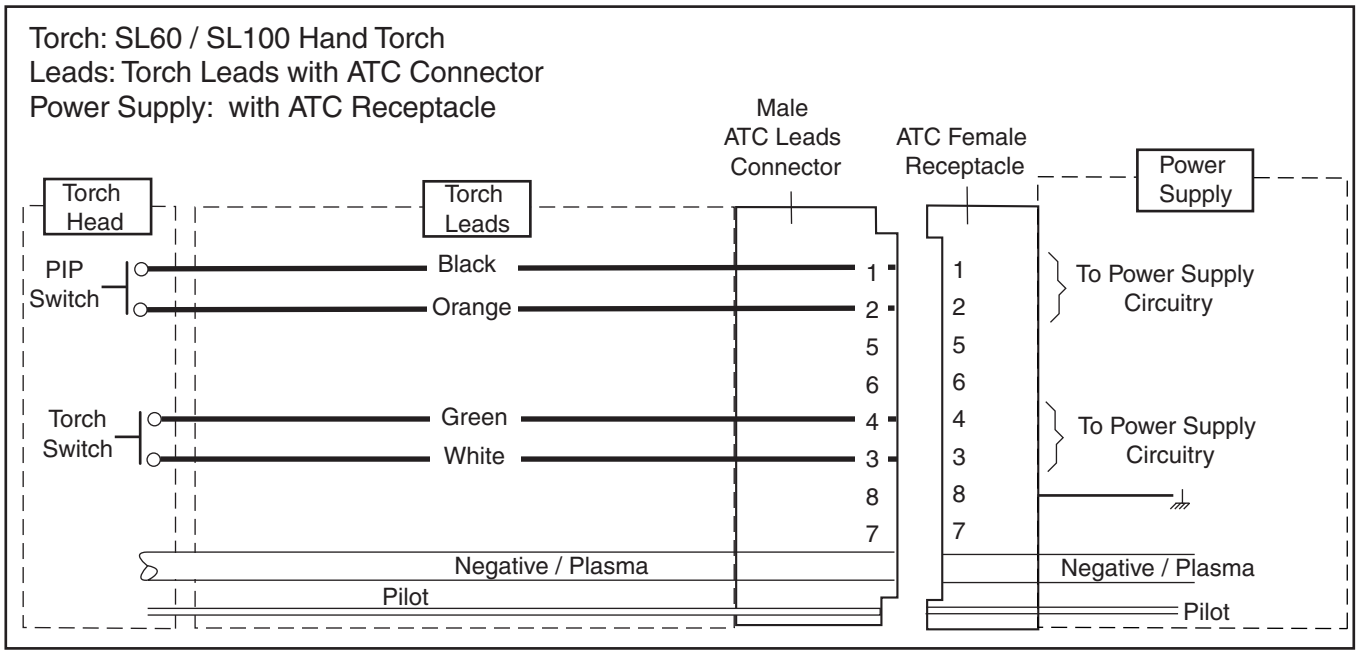
B. Mechanized (Machine) Torch Pin - Out Diagrams



Art # A-03799

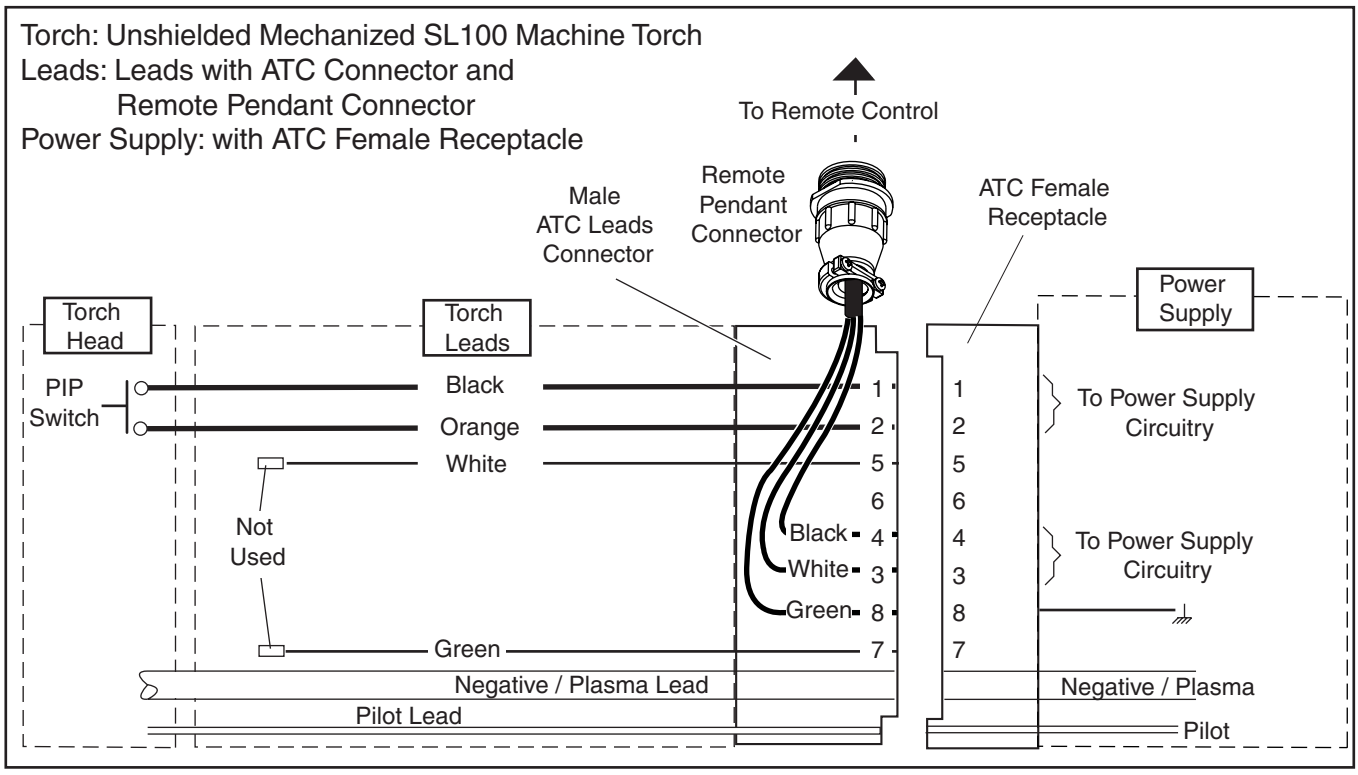
APPENDIX 15: TORCH CONNECTION DIAGRAMS

A. Hand Torch Connection Diagram



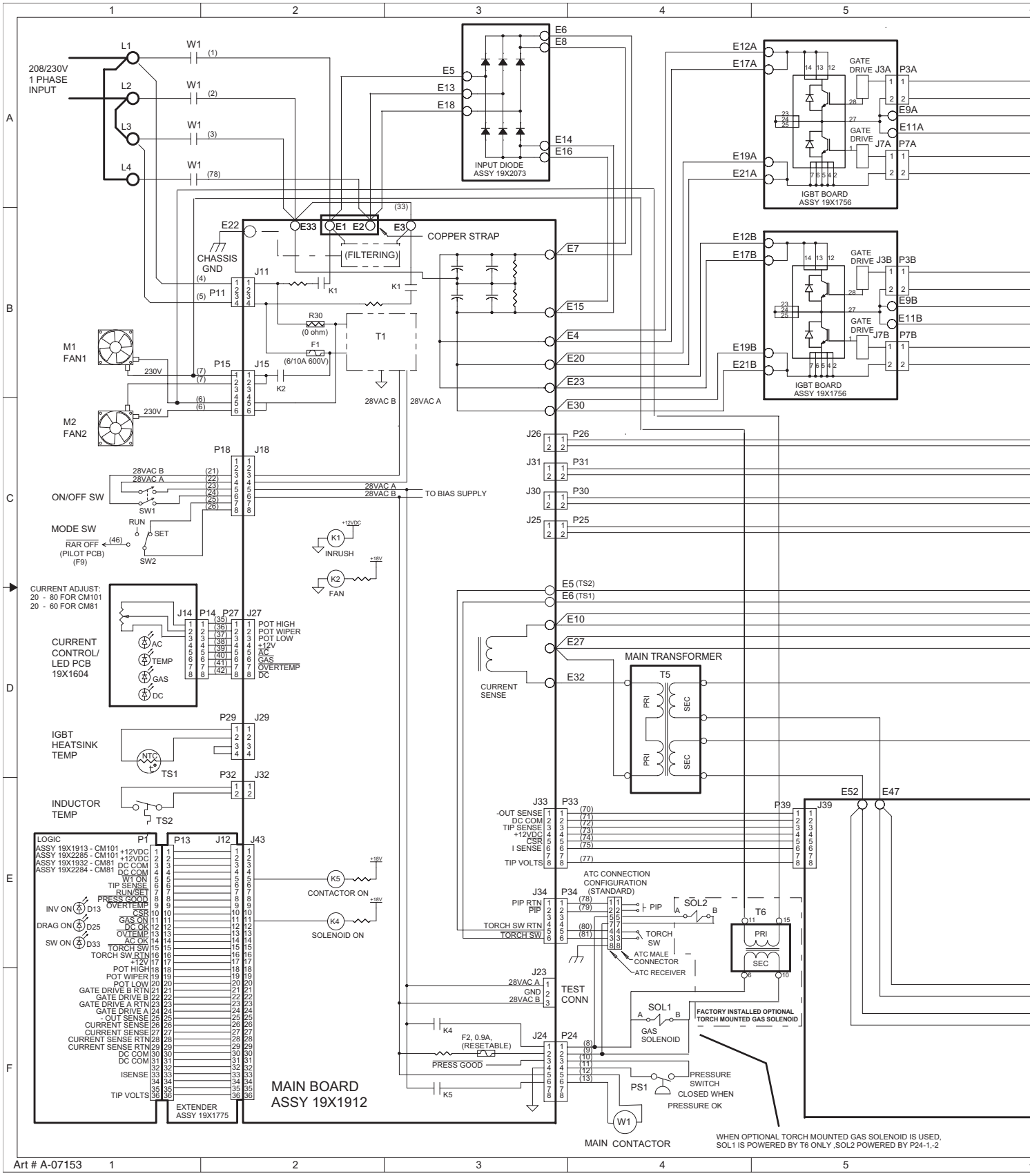
Art # A-03797

B. Mechanized (Machine) Torch Connection Diagram



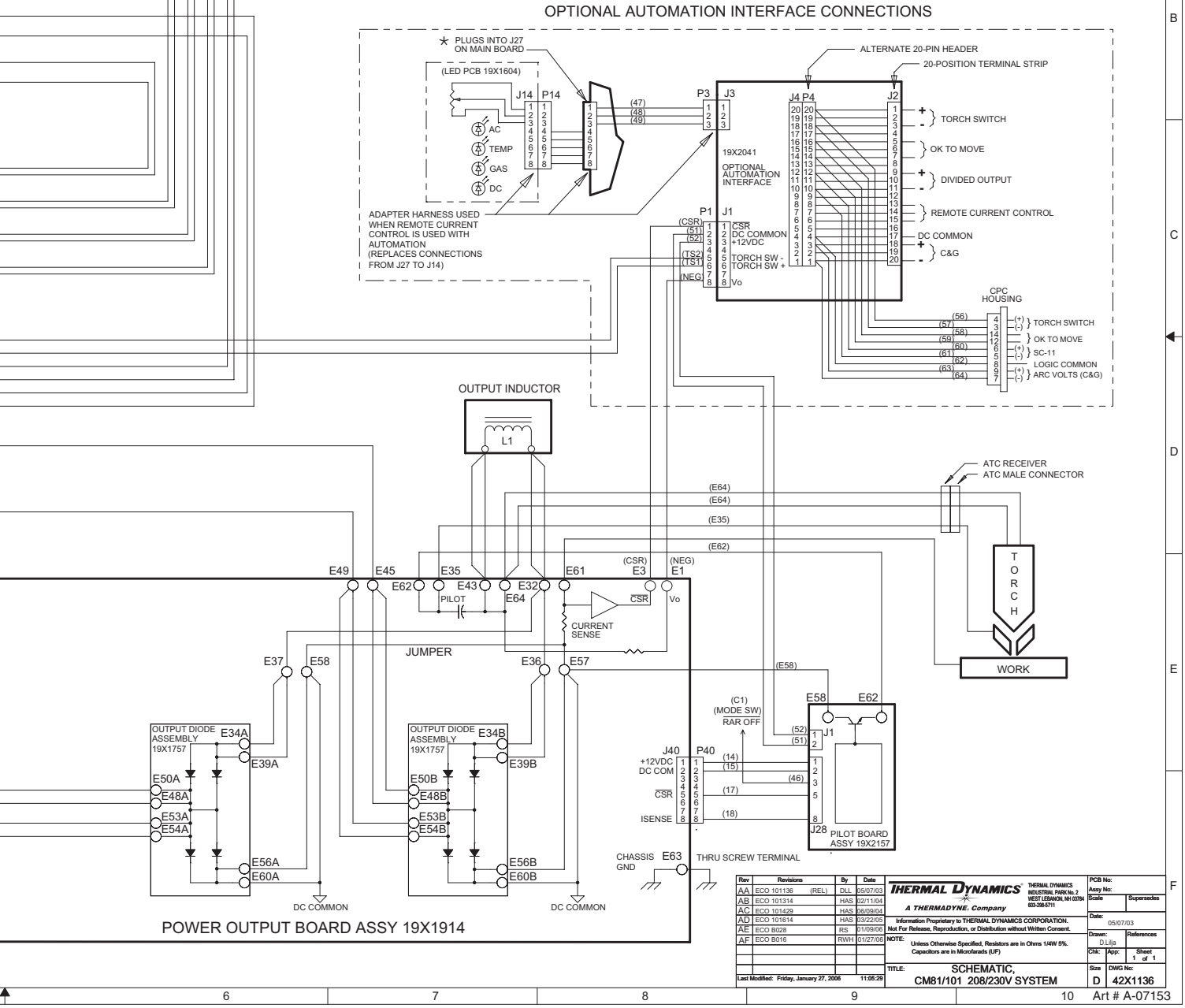
Art # A-03798

APPENDIX 16A: SYSTEM SCHEMATIC, 208/230-Volt Units



COMP	DESCRIPTION	LOCATION
F1	FUSE, 6/10A 600V KTK	B2
F2	FUSE, 0.9A, RESETABLE	F3
L1	OUTPUT INDUCTOR	D7
M1	FAN, 4.5" 220VAC	B1
M2	FAN, 4.5" 220VAC	C1
PS1	PRESSURE SWITCH	F4
SOL1	GAS SOLENOID	F4
SW1	SWITCH, ON/OFF	C1
SW2	SWITCH, RUN/SET/RAR	C1
T5	MAIN TRANSFORMER	D4
TS1	TEMP. SENSOR, IGBT HEATSINK	D1
TS2	TEMP. SENSOR, INDUCTOR	E1
W1	MAIN CONTACTOR	F4

NOTES: UNLESS OTHERWISE SPECIFIED -
1. DEPICTIONS OF CIRCUITRY INSIDE PCB BLOCKS IS FOR REFERENCE ONLY



Rev	Revisions	By	Date
AA	ECO 101136 (REL)	DLL	05/07/03
AB	ECO 101314	HAS	02/11/04
AC	ECO 101429	HAS	06/09/04
AD	ECO 101614	HAS	03/22/05
AE	ECO B028	RS	01/09/06
AF	ECO B016	RWH	01/27/06

Last Modified: Friday, January 27, 2006 11:05:29

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NOTE: Unless Otherwise Specified, Resistors are in Ohms 1/4W 5%. Capacitors are in Microfarads (UF)

TITLE: SCHEMATIC, CM81/101 208/230V SYSTEM

PCB No:
Assy No:
Scale
Supersedes
Date: 05/07/03
Drawn: D.Lilja
References
Chk:
App:
Sheet 1 of 1
Size D
DWG No: 42X1136

Art # A-07153

APPENDIX 16B: SYSTEM SCHEMATIC, 400-Volt, 415-Volt and 460-Volt Units

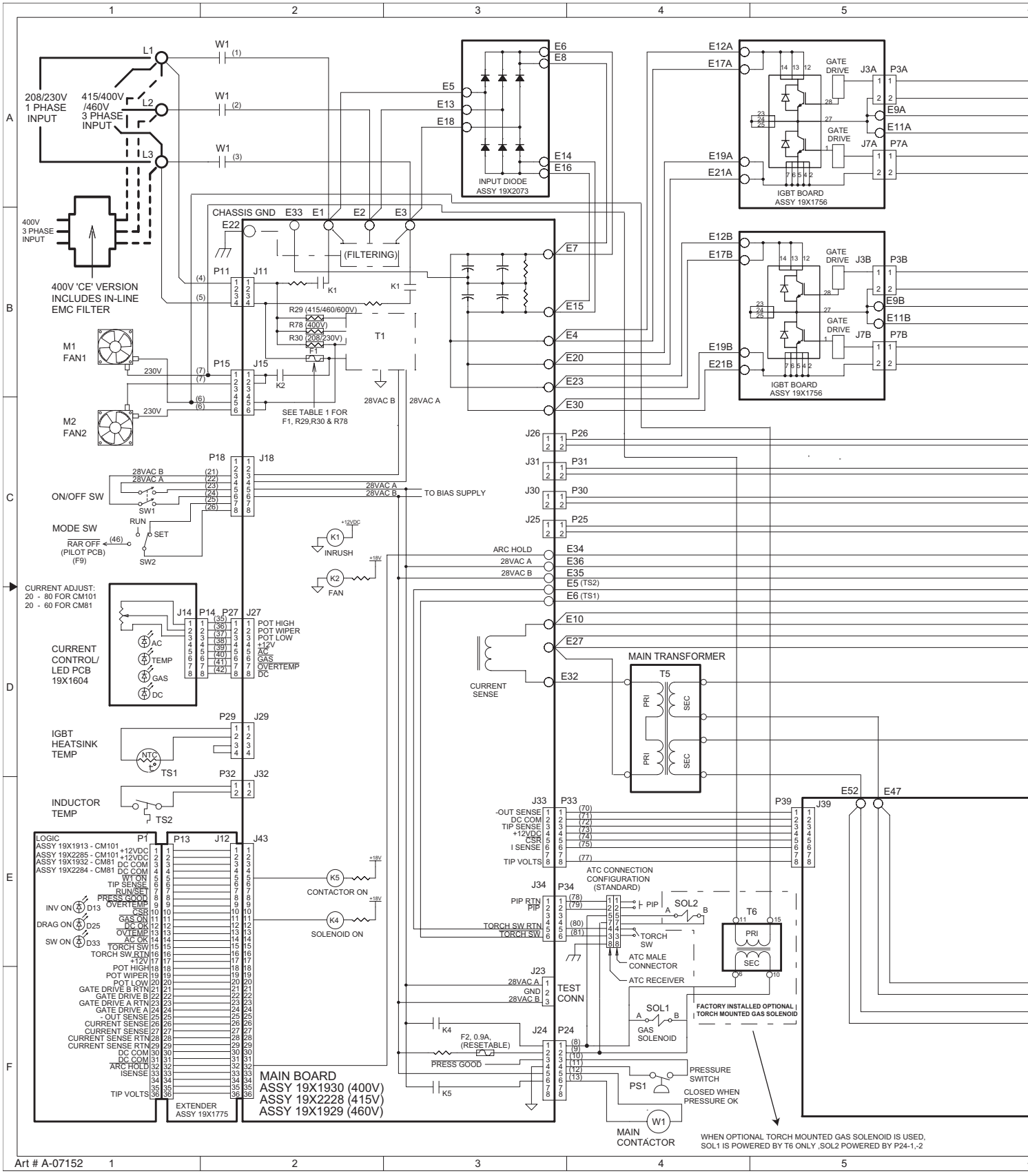


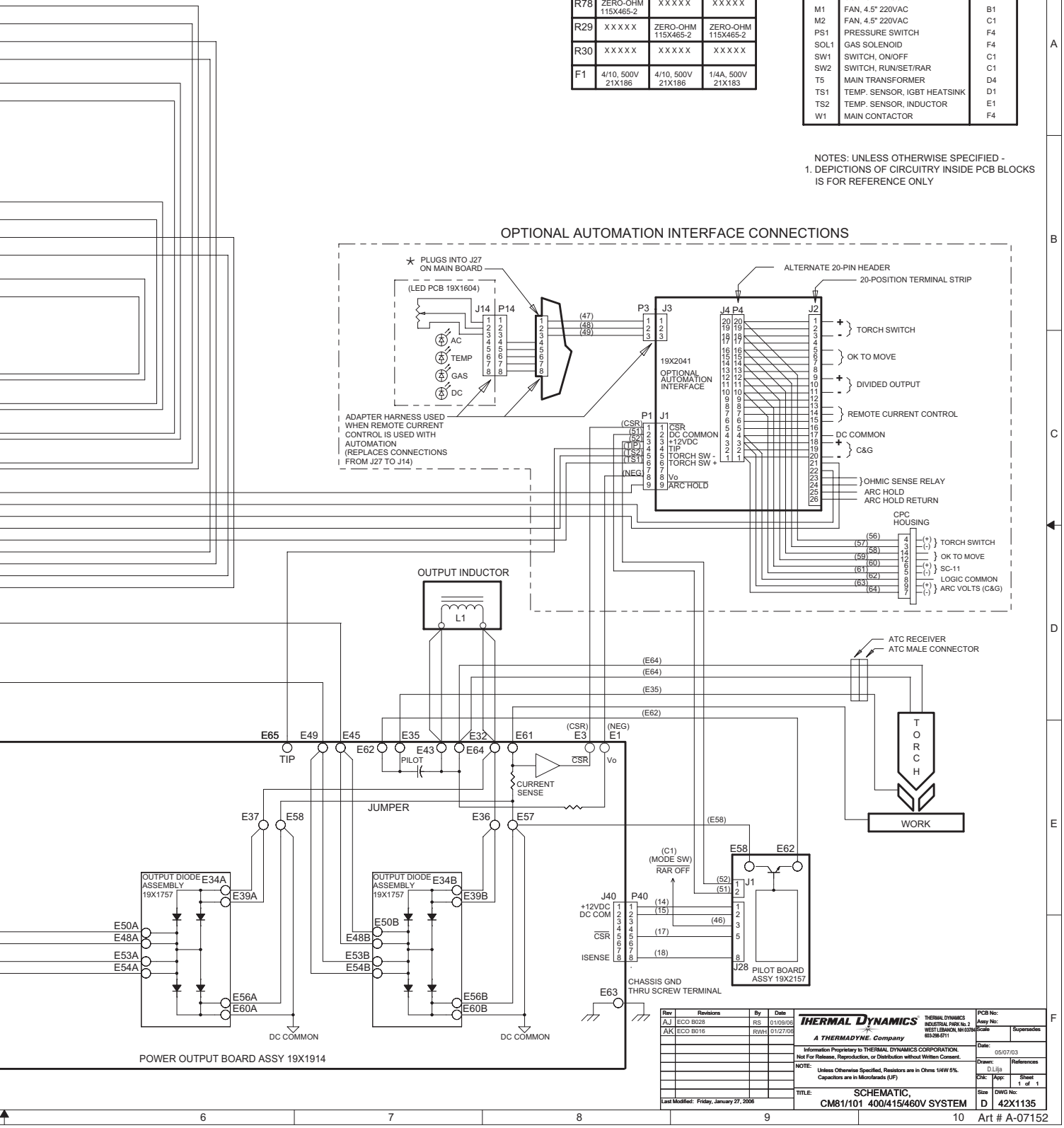
TABLE 1

	19X1930 400V	19X2228 415V	19X1929 460V
R78	ZERO-OHM 115X465-2	XXXXX	XXXXX
R29	XXXXX	ZERO-OHM 115X465-2	ZERO-OHM 115X465-2
R30	XXXXX	XXXXX	XXXXX
F1	4/10, 500V 21X186	4/10, 500V 21X186	1/4A, 500V 21X183

COMP	DESCRIPTION	LOCATION
F1	SEE CHART 1	B2
F2	0.9A, (RESETABLE)	F3
L1	OUTPUT INDUCTOR	D7
M1	FAN, 4.5" 220VAC	B1
M2	FAN, 4.5" 220VAC	C1
PS1	PRESSURE SWITCH	F4
SOL1	GAS SOLENOID	F4
SW1	SWITCH, ON/OFF	C1
SW2	SWITCH, RUN/SET/RAR	C1
T5	MAIN TRANSFORMER	D4
TS1	TEMP. SENSOR, IGBT HEATSINK	D1
TS2	TEMP. SENSOR, INDUCTOR	E1
W1	MAIN CONTACTOR	F4

NOTES: UNLESS OTHERWISE SPECIFIED -
1. DEPICTIONS OF CIRCUITRY INSIDE PCB BLOCKS IS FOR REFERENCE ONLY

OPTIONAL AUTOMATION INTERFACE CONNECTIONS



Rev	Revisions	By	Date
AJ	ECO B028	RS	01/09/06
AK	ECO B016	RWH	01/27/06

Last Modified: Friday, January 27, 2006

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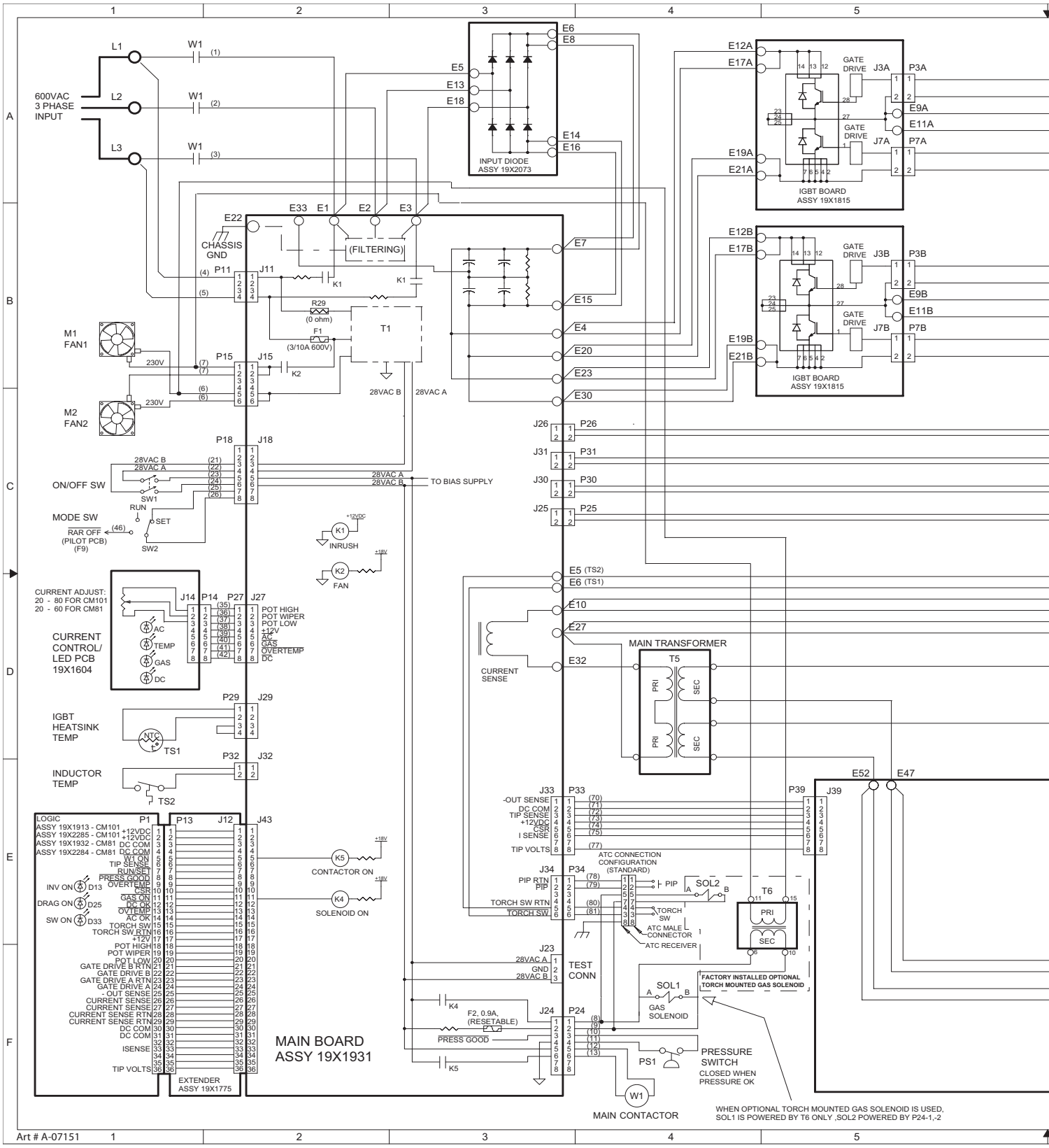
PCB No:
Assy No:
Scale
Supersedes
Date: 05/07/03
Drawn: DJ
References
Chk:
App:
Sheet 1 of 1

TITLE: SCHEMATIC, CM81/101 400/415/460V SYSTEM

Size D
DWG No: 42X1135

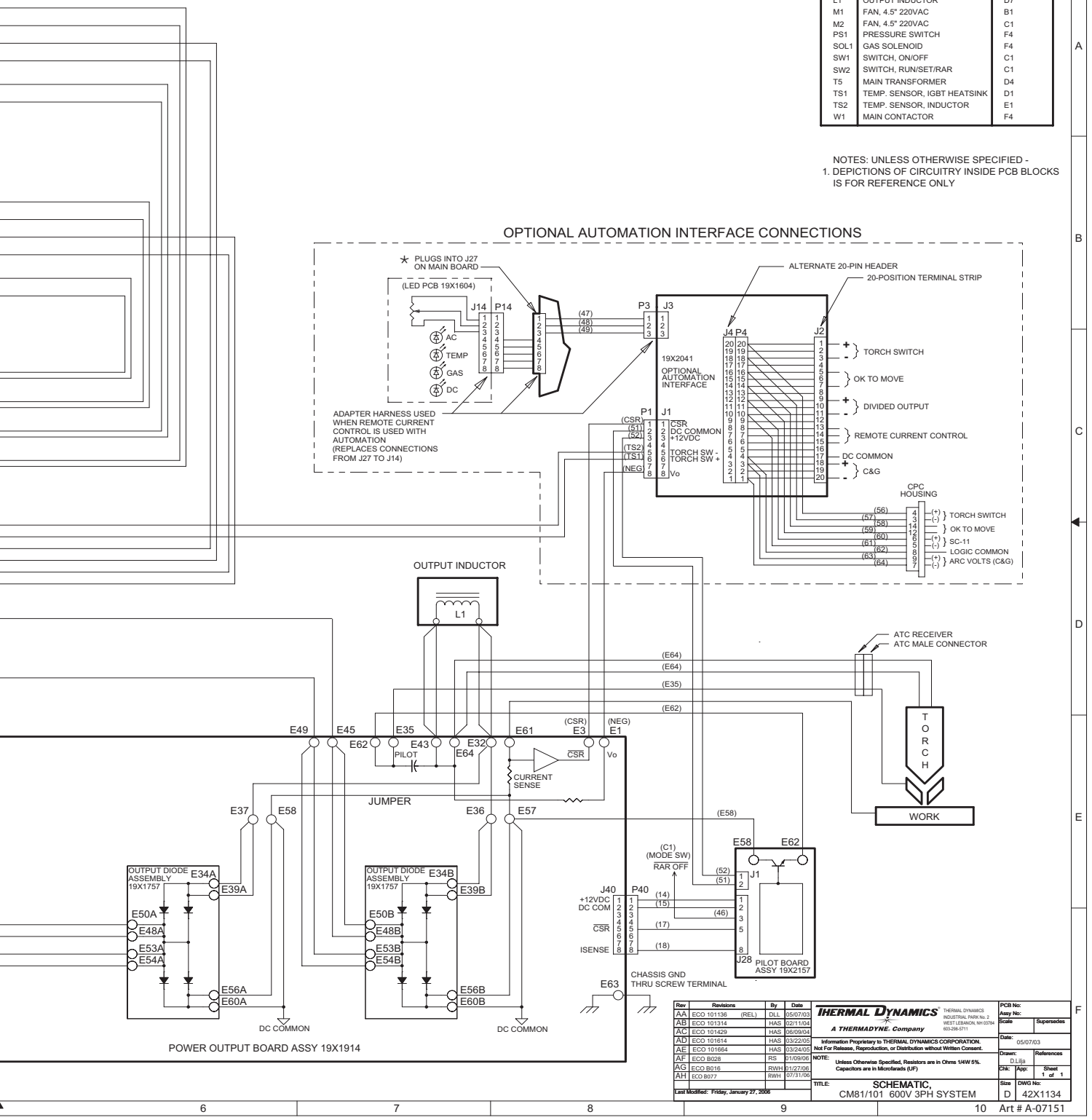
Art # A-07152

APPENDIX 16C: APPENDIX 16C: SYSTEM SCHEMATIC, 600-Volt Units



COMP	DESCRIPTION	LOCATION
F1	FUSE, 3/10A 600V FNQ-R	B2
F2	FUSE, 0.9A, RESETABLE	F3
L1	OUTPUT INDUCTOR	D7
M1	FAN, 4.5" 220VAC	B1
M2	FAN, 4.5" 220VAC	C1
PS1	PRESSURE SWITCH	F4
SOL1	GAS SOLENOID	F4
SW1	SWITCH, ON/OFF	C1
SW2	SWITCH, RUN/SET/RAR	C1
T5	MAIN TRANSFORMER	D4
TS1	TEMP. SENSOR, IGBT HEATSINK	D1
TS2	TEMP. SENSOR, INDUCTOR	E1
W1	MAIN CONTACTOR	F4

NOTES: UNLESS OTHERWISE SPECIFIED -
1. DEPICTIONS OF CIRCUITRY INSIDE PCB BLOCKS IS FOR REFERENCE ONLY



Rev	Revisions	By	Date
AA	ECO 101136 (REL)	DLL	05/07/03
AB	ECO 101314	HAS	02/11/04
AC	ECO 101429	HAS	06/09/04
AD	ECO 101614	HAS	03/22/05
AE	ECO 101664	HAS	03/24/05
AF	ECO B028	RS	01/09/06
AG	ECO B016	RWH	01/27/06
AH	ECO B077	RWH	07/31/06

Last Modified: Friday, January 27, 2006

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TITLE: SCHEMATIC, CM81/101 600V 3PH SYSTEM

PCB No:
Assy No:
Scale: Supersedes
Date: 05/07/03
Drawn: D.Lilja References
Chk: App: Sheet 1 of 1
Size: D DWG No: 42X1134

Art # A-07151

APPENDIX 17: Publication History

Cover Date	Rev.	Comments
5/5/04	--	Manual Released.
6/23/04	--	Updated system schematics per ECO 101429.
6/23/05	-	Updated 400V systems to include 415V for Australian per ECO101726
4/28/06	AA	Updated per ECO B016 (updated schematics, added c/n for logic board for mechanized units) and per ECO 101948 (torque spec for replacement input diode). Started using new cover styles. Added publication history.
9/29/06	AA.01	Added patent information and newer rev control. Added inside cover information.
3/14/07	AB.01	Updated 600 volt schematic to show new fuse.
4/13/07	AC.01	Revised C & Cr, revised Troubleshooting section (pg. 4-12) C. 4, 5, 6, made text corrections, revised Section 6, Parts List, 6.07, Item # 2 - Catalog # 9-8337, updated Inside & Rear Cover.

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